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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

FEBRUARY, 1944 VOL. 33, No. 2

Barrel-staves for skis! Sticks for ski poles! Surely, they typify the inventiveness and ingenuity of American Youth. But before we can direct their energies to worth-while, peaceful pursuits, the Axis must be given a crushing blow. Our boys are doing their part on the fighting front. Now it's up to us to put forth our best efforts on the production front . . . work steadfastly . . .

STAY ON THE JOB!

Precision Built Milling Machines Since 1888

KEMPSMITH

KEMPSMITH MACHINE COMPANY • MILWAUKEE 14, WIS., U. S. A.

SOUTH BEND LATHES

Industry Needs Manpower

TRAINED FOR PRODUCTION

Today's need for top-speed production demands replacement manpower that is trained for the job. There is no time now for retraining on the job. Every new worker must have fully acquired his basic skills if he is to do his work efficiently.

South Bend Lathes offer numerous advantages in training manpower for production work. Through their use trainees aquire skill on the same lathes that they are likely to use in industry. The operating ease, accuracy, safety features, and versatility of these lathes make them popular with both instructors and trainees.

There is a South Bend Lathe for practically every training purpose. They are made in Engine Lathe and Toolroom Lathe types in 9" to 16" sizes. South Bend Turret Lathes are made with 9" and 10" swings. For complete information, write for Catalog 100-C.

TEACHING HELPS FOR SHOP TRAINING

South Bend training helps—books, sound films, wall charts, and service bulletins on the care and operation of a lathe—are available for speeding the training of new lathe operators. Write for your copy of Bulletin 21-C.

★ **BUY WAR BONDS** ★

SOUTH BEND LATHE WORKS • ***Lathe Builders for 37 Years*** • **SOUTH BEND 22, INDIANA**

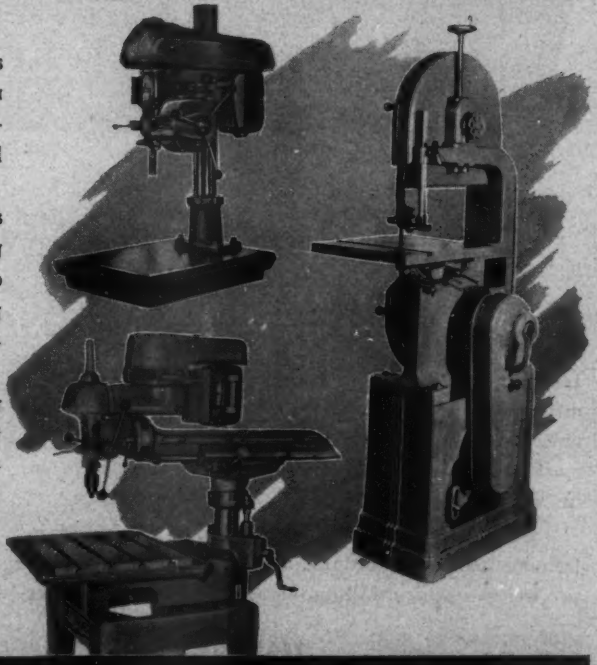
THEY FIT MORE JOBS IN INDUSTRY

WHEN TRAINED ON WALKER-TURNER MACHINE TOOLS

STUDENTS trained on Walker-Turner Machine Tools aren't "square pegs" or "round pegs" fit for only a relatively few spots in Industry. They have a background built on versatile machine tools that are used *throughout* Industry.

Moreover, Walker-Turner Machine Tools possess several features which make them ideal for training "green" hands. They are easy to operate, simple to understand, ruggedly built to stand up under long hours of inexperienced handling, and fully safeguarded.

For fast, thorough, versatile training, Walker-Turner Machine Tools can't be beaten. At prices within easy reach of your school budget, they are promptly available for war production training. Send for latest catalog



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MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
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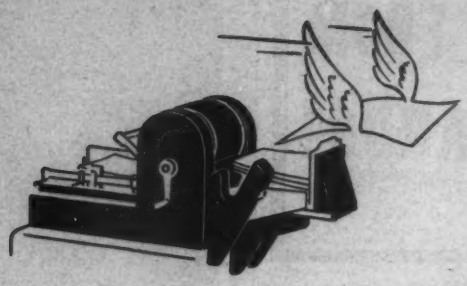

Rolling for War

You can't be two places at once, or do more than one thing at a time. But materials prepared on the Mimeograph duplicator do help to keep your instruction individualized, and so spread your time and talents further.

Like most vocational instructors you have probably kept your Mimeograph duplicator rolling full time and overtime these two years of war, producing training bulletins, course outlines and other teaching helps.

If, in the process, your Mimeograph equipment has been strained, if it is too old, or is not adequate for your present needs, we suggest you write us. We may be able to help. For information mail the coupon below to A. B. Dick Company, Chicago.

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Our Mimeograph duplicator is not adequate for our needs. Send us information.

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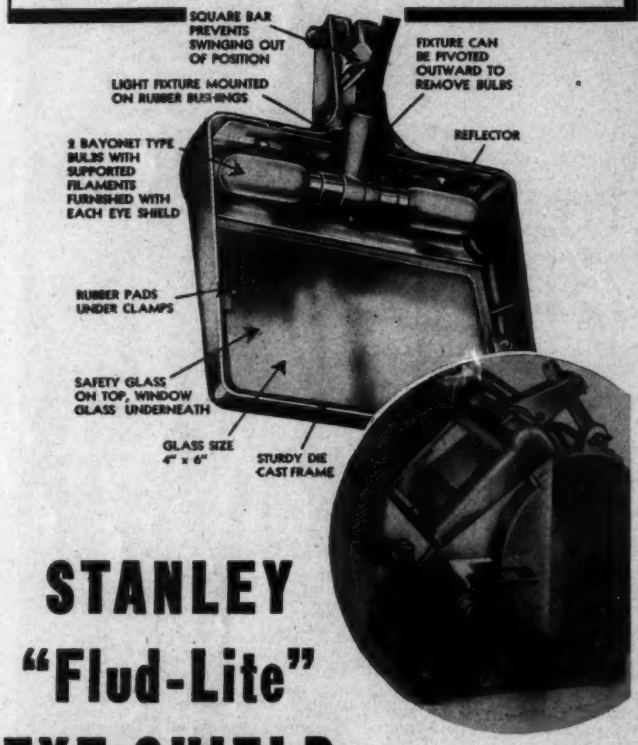
PROTECT STUDENTS' EYES FROM GRINDING HAZARDS!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FIXTURE CAN BE PIVOTED OUTWARD TO REMOVE BULBS
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RUBBER PADS UNDER CLAMPS
SAFETY GLASS ON TOP, WINDOW GLASS UNDERNEATH
GLASS SIZE 4" x 6"
STURDY DIE CAST FRAME

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Gives positive eye protection with excellent light directly on the work. Adjustable up and down for standing or sitting position. Cannot be moved to non-guarding position without dismantling. Can be easily applied on bench or belt-driven grinders. Write for details.

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STANLEY Electric Tools

EDUCATIONAL DEPARTMENT, STANLEY ELECTRIC TOOL DIVISION

THE STANLEY WORKS, NEW BRITAIN, CONN.

Stretching TOOL STEEL

By simply hand stoning the edges of machine cutting tools the instant they show the slightest tendency to become dull, Industry under pressure of war demands is achieving tremendously increased production. Besides the saving of tool steel, hand stoning insures better cuts and reduces time lost in regrinding at the wheel.

Exactly the same principle applies to hand tools. The process is so simple, the investment so small as to be negligible. Good oilstones, like those in the Norton Abrasives* line last for years.

Students easily form the habit of sharpening tools correctly, so give them famous India (aluminum oxide) or Hard Arkansas (natural novaculite) Oilstones, the leaders among expert mechanics.

** It is a complete line—both electric furnace and natural stones in hundreds of shapes, sizes and grits.*

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DIVISION OF NORTON COMPANY

TROY, N. Y.

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"Tools are Weapons —Treat 'em Right!"

Read these facts about tool supplies and restrictions

TOOL STEEL is a vital war material—so urge students to take good care of drill bits, taps, files, chisels and other cutting tools. Teach them to take good care of your Black & Decker Tools, too. They are the most widely used electric tools in war industry—demand still exceeds supply—and they are still subject to priority restrictions. BUT . . .

THERE ARE NO RESTRICTIONS on prompt, expert service—on repairs or replacement parts for Black & Decker Tools—through Black & Decker's 26 Factory Service Branches from coast-to-coast.★

THERE ARE NO RESTRICTIONS on many attachments and supplies that help you train students to do many different types of work with your Black & Decker Drills, Sanders, Grinders and other Portable Electric Tools—the same tools they're most likely to find where they get a job.

THERE ARE NO RESTRICTIONS on our free booklet, "The Care and Maintenance of Portable Electric Tools." For copies for student training address: The Black & Decker Mfg. Co., 780 Pennsylvania Ave., Towson-4, Maryland.

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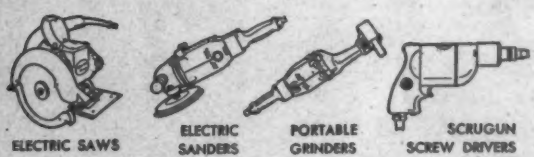
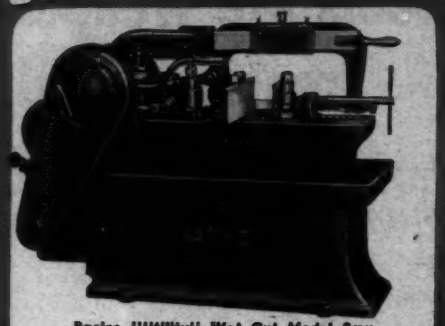
PORTABLE ELECTRIC **TOOLS**



ELECTRIC SAWS — ELECTRIC SANDERS — PORTABLE GRINDERS — SCRUGUN SCREW DRIVERS

All your metal cutting
ON JUST ONE SAW



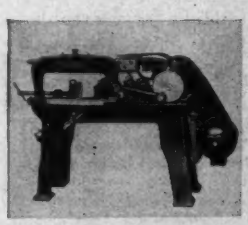
Racine "Utility" Wet Cut Model Saw
Capacity 6" x 6"

MAKE TRAINING SAFER, EASIER and FASTER

Racine "Utility" model metal cutting saws are the machines for use in vocational schools. They cut any metal from soft aluminum tubing to tough alloy steel. Modern in design and safeguarded throughout. They are used in the shops of modern industry, thus providing students with advantageous experience in modern metal cutting methods.

Racine "Utility" saws have hydraulic control of feed and pressure. This feature reduces blade breakage. It requires little or no attention and a minimum of servicing.

SIMPLE MECHANISM • HIGH EFFICIENCY • LOW IN PRICE



Racine "Utility" Dry Cut Model Saw—Capacity 6" x 6"

Equipped with the latest control devices, so simple that anyone can operate, these saws are the best dollar value on the market. A simple graduated dial controls the feed pressure—a small needle valve controls the rate of feed. This machine does your metal cutting fast, efficiently and with maximum safety. Write today for complete information and prices. Address Dept. IA-2. No obligation whatever.

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OF RACINE "Utility" SAWS

- ***OIL HYDRAULIC FEED*** — Provides accurate control of feed and pressure.
- ***HYDRAULIC UNIT***— Simple, compact. Nothing to get out of order. Packless and leak-proof.
- ***DRIVE*** — Belts and chain drive completely guarded. Adjustable motor bracket.
- ***VISE*** — Quick acting — positive grip, for cutting any angle up to 45°.

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PRECISION TOOL ROOM AND PRODUCTION LATHES

BEST known as quality tool room lathes, SHELDON Precision Lathes are also ideally suited for much second operation and other production work because of their extra collet capacity, sturdy construction, accuracy and available production features including: Lever operated Bed Turret, or Tool Post Turrets, Lever operated Collet Attachments, Tailstocks, Double Tool Posts, 4-speed underneath motor drives, etc. If you are looking for a 10", 11" or 12" Precision Lathe for the Tool Room or Production Line, be sure to see the SHELDON Lathe before you order.

SHELDON MACHINE COMPANY, INC.
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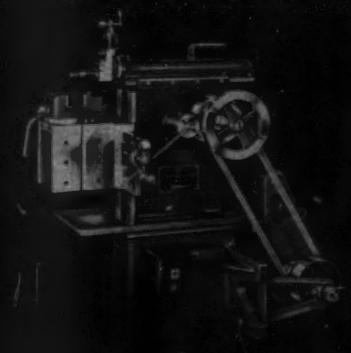
RHODES
7" HORIZONTAL SHAPER
3½" VERTICAL SLOTTER



Convertible
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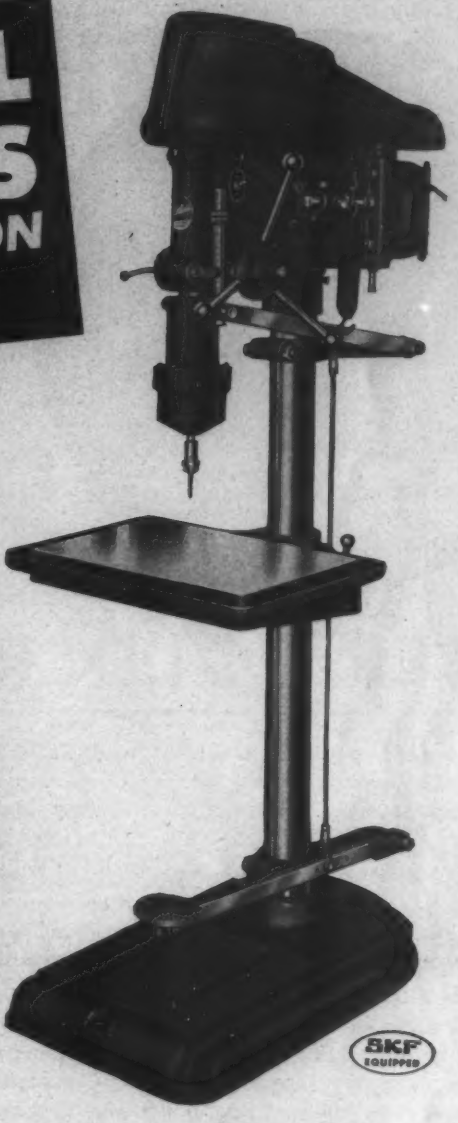
Atlas DRILL PRESS WITH WAR PRODUCTION ATTACHMENTS



Wherever there are holes to be drilled — in thousands of war plants or with the mobile machine shops of our armed forces — Atlas Drill Presses are setting great efficiency and precision records. If your program includes training in production drilling and tapping, write for full details on the Atlas No. 73 heavy-duty drill press equipped as shown. It's a natural for training because it's tops for production!

ATLAS PRESS CO.

271 N. PITCHER ST., KALAMAZOO 13D, MICHIGAN

DECIMAL EQUIVALENTS
THE MODERN BACK GEARED SCREW CUTTING LATHE
60° V-TYPE THREAD DIMENSIONS
THREAD FORMS AND FORMULAS
LATHE CUTTING TOOLS

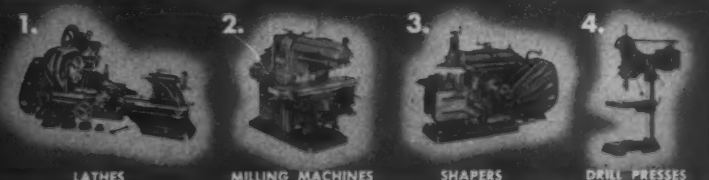
WALL CHARTS

Large easy-to-read charts with up-to-date technical information on a variety of subjects. The largest chart is 35½" x 25½", others 16" x 21". Complete set of five charts sent postpaid for $0.25 per set.

CONDENSED SPECIFICATIONS

Drills to Center of Circle	15" diam.
Maximum Distance, table to chuck	40½"
Maximum Distance, table to tapping attachment	37½"
Chuck Capacity	½"
Oil Table	10½" x 16½"
Spindle Travel	4"
Overall	16½" x 30" x 72" high

Atlas 4 TOOL TEAM FOR SMALL-PARTS MACHINING



There's an Important Post-War Field for...

Photo Courtesy Bell Aircraft Corporation

KESTER SOLDER

● The boys and girls you teach to solder — with KESTER — will find the skill readily marketable today in war production, and fully as much in demand in industry after the war is over.

● Kester Flux-Filled Solders are *industry's standard*. They form an important part of the post-war production plans of numerous manufacturers. Knowledge of Kester Flux-Filled Solders and how to use them will be permanently valuable to your students.

● Classes learn soldering quicker with KESTER. They turn out better work, because flux and solder are both applied in one simple operation. No separate flux — in a wasteful, messy pot — to spatter and disfigure floors and benches.

● You'll get a lift out of the neat, workmanlike results your students will have with Kester Flux-Filled Solder. Their success will be yours! Order from your wholesaler.

★ BUY WAR BONDS ★

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Finest Quality FOR 45 YEARS KESTER SOLDER

KESTER
FLUX-FILLED SOLDER

ARMSTRONG

TURRET LATHE AND SCREW MACHINE TOOLS

Today, America Needs TURRET LATHE and SCREW MACHINE OPERATORS

The transition from tooling-up to all-out production has increased the need for turret lathe and screw machine operators. When preparing your courses to help fill this need it would be well to build them around ARMSTRONG TURRET LATHE and SCREW MACHINE TOOLS. These are provided for the basic operations, and take standard drills and knurls or cutters that anyone can quickly grind from stock shapes of high speed steel. Permanent, multi-purpose tools, they reduce tooling-up to the selection of cutters, adjustment for clearance and tightening of set screws.

Write for catalog C-39a

ARMSTRONG BROS. TOOL CO.
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Eastern Warehouse & Sales: 199 Lafayette St., New York

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TOOL CONSERVATION STARTS IN SCHOOL!

GENERAL PURPOSE TOOL ROOM GRINDING

Grading Recommendations for School Shops

A-A ALOXITE BRAND ALUMINUM OXIDE WHEELS

MATERIAL TO BE GROUND	WHEEL TYPE	WHEEL SIZE	GRADING
SURFACE GRINDING			
High Speed Steel or Hardened Tool Steel	1	6", 7", 8", 10" (Diameter)	A46F2-S-100
SHARPENING CUTTING TOOLS			
High Speed Steel	6	5"x1½"x1¼"	A46-P-100
High Speed Steel	11	3½"x1½"x1¼"	A46-P-100
High Speed Steel	12	6"x½"x1¼"	A60-S-100

MUCH of the cause for the shortage in tool steel lies in waste due to improper handling—the simple fact that inexperienced workers don't know how to take care of good tools.

Careless handling may chip delicate edges; overlong operation between sharpenings causes undue grinding losses. It is important, too, that the correct grinding wheel be used for grinding. Use this chart to show your students the wheels to use for tool grinding.

Then, when they get into industry, they will know how to keep tools at peak efficiency, and save tool steel at the same time!

CARBORUNDUM TRADE-MARK ABRASIVE PRODUCTS

Clip this chart and file for future reference

Every hour this war is shortened will save $12,000,000. The lives it will save are priceless. Let's get it over with—quickly.

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N. Y.

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MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

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Ingredient of Victory

PRECISION instruments by Millers Falls are at work today on the many new precision jobs that war has created. Our weapons must be right, to the close tolerances that assure their effective operation in combat.

Thus precision becomes an ingredient of victory. One of the invisible qualities of a weapon that may spell the difference between a battle won or lost.

One in Quality — Now One in Name

You knew these same fine instruments under the name of Goodell-Pratt. For generations, that name stood for quality and precision in a tool. But since the union of Millers Falls and Goodell-Pratt in 1931, Millers Falls has been producing these instruments.

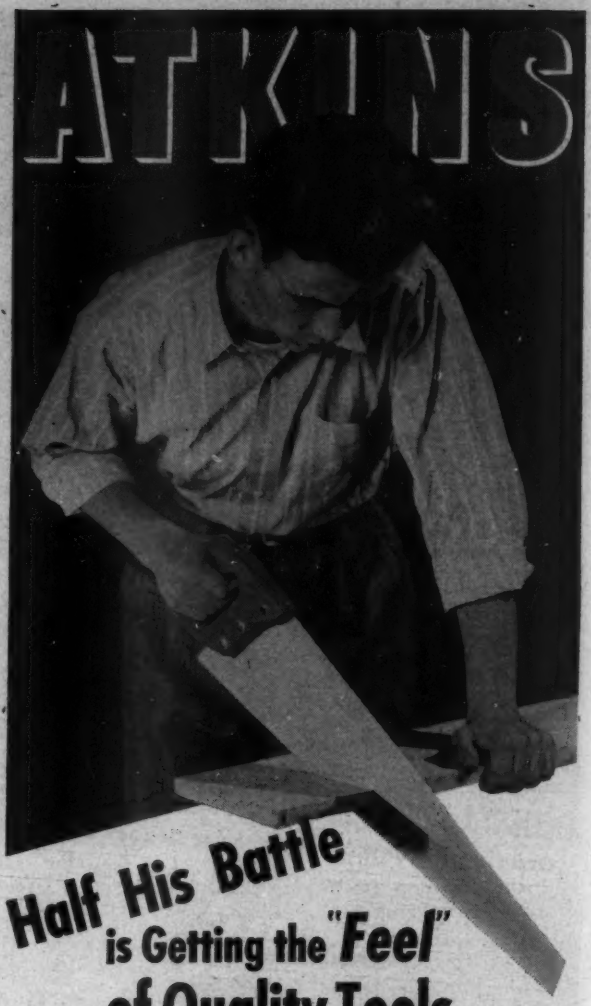
So the trade name that appears on them is that of Millers Falls. The quality is the same. Only the brand name is changed.

War's demands have created substantial increases in Millers Falls' production capacity. So these fine instruments, and other excellent tools in Millers Falls' wartime line, represent unusual values in tools that deliver long, dependable, accurate service. Write for details.

Calipers and Dividers • Feeler Gages • Surface Gages • Micrometers
Depth Gages • Combination Sets • Steel Rules

MILLERS FALLS TOOLS
SINCE 1868

MILLERS FALLS COMPANY **GREENFIELD MASS. U.S.A.**



Half His Battle is Getting the "Feel" of Quality Tools

• To master a craft requires more than a willing pair of hands and an eager mind. Unless the tools a beginner uses "cooperate", he is apt to make slow headway. Recognizing this, many instructors favor Atkins Silver Steel Saws for manual training. Each saw in the line is carefully designed for easy handling qualities — and for accurate cutting on the work for which it is intended. There are types for every kind of sawing in wood, metal and plastics. The complete Atkins catalog gives full information —write for a copy today.

FREE—Wall Chart on Saw Fitting

Illustrates in detail the right way of filing and setting saw teeth, 19" x 25"— suitable for wall mounting. Write for free copy.

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Silver Steel **SAWS**

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BAND FILER

DoALL work table adjustment—from 10° back to 30° forward—simple, quick and POSITIVE.

DoALL Band Filer—provides substantial economies in production, tooling and maintenance work on all types of metals, wood, fibre and plastics.

Production Filing TO "DIE-FIT" TOLERANCES

Flat or shaped surfaces—acute or right angles or bevels—internal or external—all are precision filed at amazing speed because of DoALL positive work controls.

Widest selectivity in file size, shape, cut and speed for every type of work; rigid file back and work table adjustment; all these assure precise *file-broaching* output in important volume!

Investigate the greater production advantages of DoALL Band Filing—telephone your nearest DoALL Sales Office—now!

FREE Skilled engineering service for a time and method study of your filing problem—bring or send work specimens!

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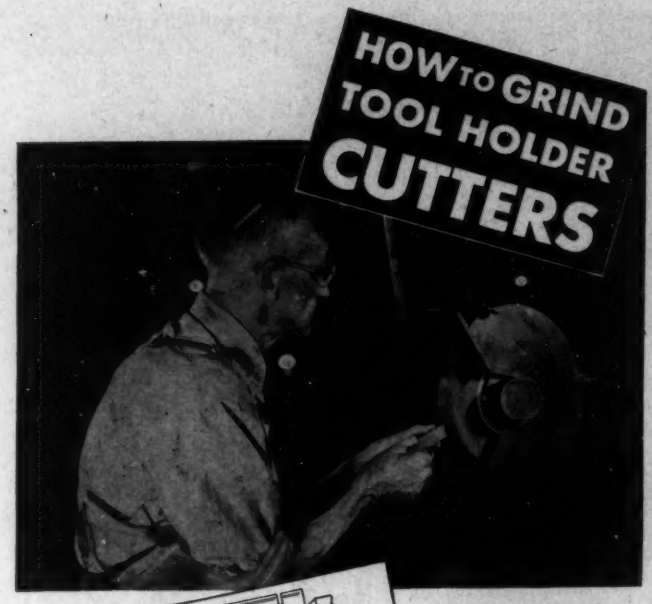
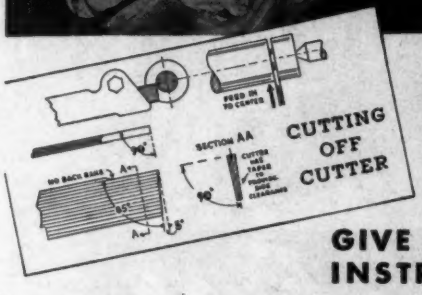
INDUSTRY'S NEW SET OF TOOLS SOLD AND SERVICED BY 34 DoALL OFFICES





FREE! DATA SHEETS GIVE COMPLETE INSTRUCTIONS

Complete instructions for grinding cutter bits for Williams' Tool Holders for lathe, shaper and planer use; 39 line drawings show *both* grinding and applied angles recommended for machining cast iron, steel, brass and bronze, and show how to apply tool to work.

Fifteen other helpful data sheets, as listed below, are also available. Use the coupon.

1. Data on "Superior" Wrenches.
2. Data on Boring Tools.
3. Data on Chain Pipe Tongs.
4. Data on "Supersocket" Wrenches.
5. Data on Lathe Dogs.
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7. Data on Turning Tools.
8. Types of "Superior" Wrenches.
9. Use of "Supersocket" Wrenches.
10. Data on Eye Bolts.
11. Data on "C" Clamps.
12. Use of Cutting-Off Tools.
13. Use of Knurling Tools.
14. External Thread Cutting.
15. Internal Thread Cutting.
16 to 21. Six Data Sheets on grinding cutters for Tool Holders.

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J. H. Williams & Co., Dept. I-244, Buffalo, N. Y.

Please send Data Sheets circled below: ☐ for binders ☐ for posters

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—a tested introduction to inspection principles—

Mollard's ESSENTIALS OF PRECISION INSPECTION

This work-manual offers detailed instruction in the use of the various measuring instruments; technical and related information on checking the location of threads, gears, etc.; and the procedures to be followed in checking a piece of work to specifications. It lays the foundation for the development of skill in using and applying precision tools and instruments. Textbook edition, $2.40.

Send for a copy on approval

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with Campbell Finishing Products!

For Directors, Supervisors and Shop Instructors, the M. L. Campbell Company offers special products to help streamline and speed-up Shop work to meet present war-industry needs. You'll find it pays to "Call on Campbell."

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SUSTAINED

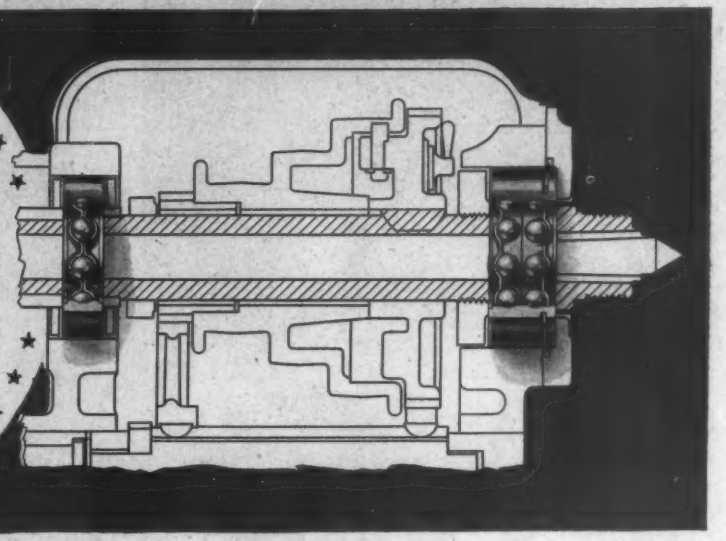
A FINER

Spindle Accuracy!

FEATURE OF LOGAN LATHES*

Brief
SPECIFICATIONS

- Swing over bed 10½"
- Bed length 43⅛"
- Spindle hole 25/32"
- Precision ground ways: 2 prismatic "V" ways; 2 flat ways
- 12 spindle speeds—30 to 1450 per minute



Precision, Pre-Loaded Ball Bearing Headstock is Standard Equipment on All Models

Your purchase of a lathe is an investment. To be profitable, it should be a *long term* investment in speedy, accurate production. It will be if the lathe is a Logan, because Logan engineering designed it that way . . . throughout! For example, to assure sustained accuracy of the spindle, the headstock is equipped with special New Departure Ball Bearings. These bearings, of extreme precision, are pre-loaded so that the pressure of the cutting tool . . . either radial or thrust . . . causes a minimum deflection of the spindle. In addition to "pre-loading" . . . these ball bearings are grease sealed . . . requiring no lubrication and no adjustment for their entire life. Moreover, the higher operating speed of the Logan Lathe, due to its ball bearing spindle mounting, enables a shop to take every advantage of modern, high speed cutting methods. Production is increased and unit costs reduced.

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CHICAGO 30, ILLINOIS

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A NAME TO REMEMBER WHEN YOU THINK OF LATHES

*This advertisement is one of a series describing the finer features of Logan Lathes . . . Look for the next of the series

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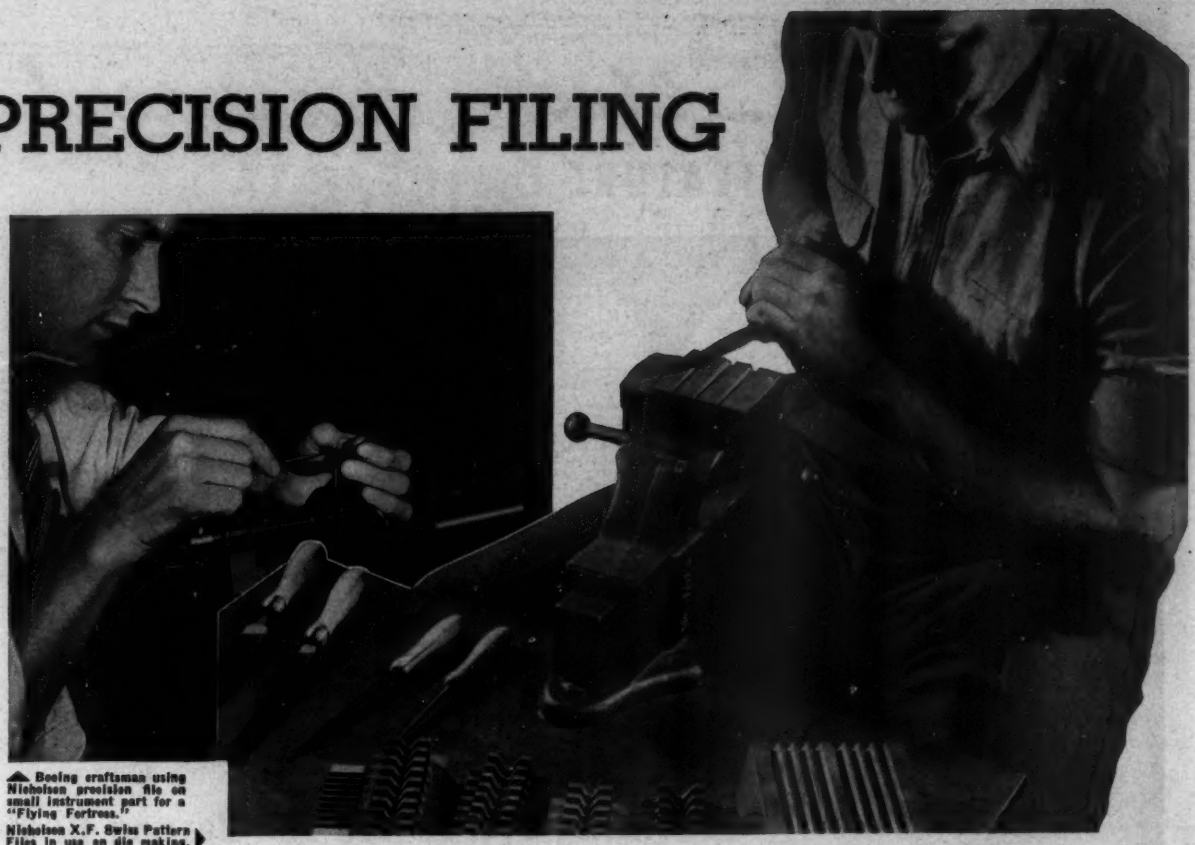

▲ Boeing craftsman using Nicholson precision file on small instrument part for a "Flying Fortress."

Nicholson X.F. Swiss Pattern Files in use on die making. ▶

THERE is a *right file* for every kind of job and material—and a *right way* to use it. The more precise the job, the more important it is that both file and filing method are correct. Thus, precision filing requires the utmost skill and an almost errorless knowledge of the types, shapes and sizes in the precision-file category.

Precision files are used in a wide range of industries—in aircraft, automotive, radio, engine, household appliance, machine-tool, and many other lines of manufacture . . . to say nothing of the vast watch, clock, jewelry, optical and other fine-instrument businesses.

Die and pattern making, model building, delicate-parts finishing, wood, ivory and precious-metals carving constitute some of the kinds of work in which precision files are required. Removing burrs, cleaning out corners, rounding out slots, smoothing and fitting are some of the operations involved.

While many of the smaller and finer cut regular types of files are entirely practical for precision work, a much wider range of shapes and sizes of precision files is classified as "Swiss Pattern." Those made by Nicholson are known as "X.F. Swiss Pattern" and are manufactured in accordance with the original Swiss designs, which differ in a number of respects from American Pattern. They are made to more exacting measurements and in much finer cuts. Points are smaller and tapers longer (see comparisons at the right).

The making of precision files calls for file cutters of years of experience and superior skill. With Nicholson craftsmen, workmanship on these types of files is a *specialized art*. It is virtually their life-work. When mill-supply and hardware houses sell you Nicholson X.F. Swiss Pattern, you have precision files whose design, accuracy and quality are unexcelled.

EXTRA ◆ TRADE X.F. MARK ◆ FINE

Nicholson X.F. Swiss Pattern Files include such groups as: Die Sinkers, Round and Square Handle Needle, Filing Machine, Silversmiths Riffflers, Die Sinkers Riffflers, Brooch.

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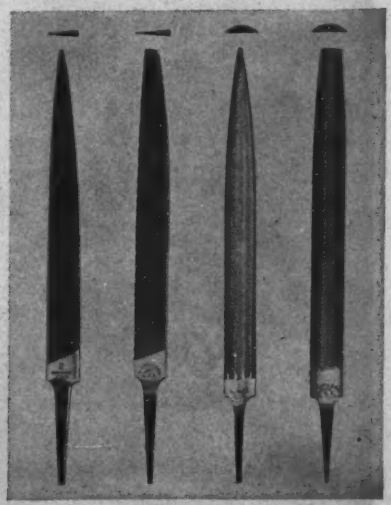

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 33 FEBRUARY, 1944 Number 2

In This Issue

Shop instructors looking for tests that may be used for supplementing those already on hand for the end of the first semester of 1943–44 may find the tests submitted by Walter G. Hjertstedt, William Cecil Ford, W. W. Sturtevant, and W. H. Bowers helpful and appropriate.

Present-day needs are discussed in "Training Aircraft Engine Mechanics" by Harry R. Wilson, and "Gearing the General Shop to War Needs" by G. H. Billingham.

Those looking for the solution of problems arising out of specific subjects or conditions may find helpful suggestions in "Industrial Arts for the Slow Adolescent" by Louis G. Wust, "Course Outline in Related Social Studies" by H. Boodish, and "Instructional Methods in Distributive Education" by Murray Banks.

Many industrial-arts teachers will find profitable reading in Charles P. Richardson's "A Reinterpretation of Industrial-Arts Objectives."

The problems and projects, in this issue, present several fine teaching and illustrative devices, together with a number of tried shop and home projects.

This Month's Cover

The illustration chosen for the February cover of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION shows girls at Richards Vocational School, Chicago, Ill., learning the *how* as well as the *why* of giving first aid.

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Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

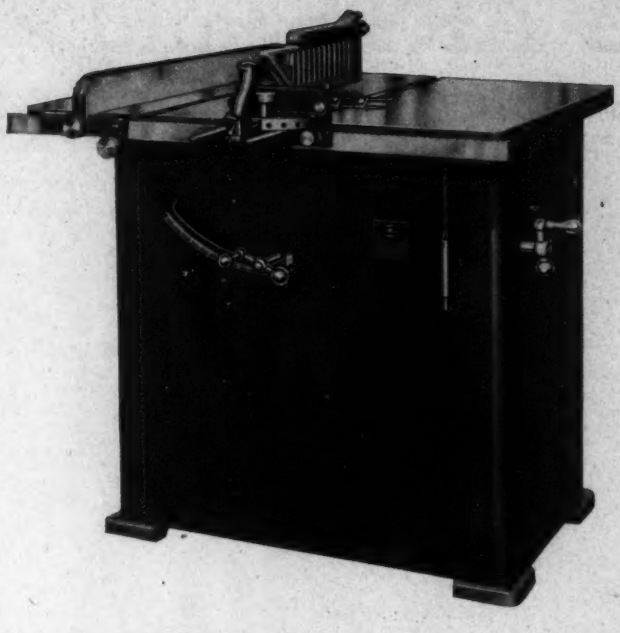
Entered January 2, 1914, as Second-Class Mail Matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright, 1944, by The Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, November 25, 1930. Published monthly except during July and August.

Subscription Information. — Subscription price, $2.50 per year, payable in advance. Canadian postage, 50 cents; Foreign Countries, 50 cents. Copies not over three months old, 35 cents; more than three months, 50 cents. Notice for discontinuance of subscriptions must reach Publication Office in Milwaukee at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

PUBLISHED BY THE BRUCE PUBLISHING COMPANY, 540 N. MILWAUKEE STREET, MILWAUKEE 1, WISCONSIN

Eastern Office: 330 W. 42nd St., New York 18, N. Y. — Western Office: 66 E. South Water St., Chicago 1, Ill.



W-55 CIRCULAR SAW

Students receiving school shop instruction usually are not finished craftsmen. They are not expected to be. That's one of the main reasons why they need woodworking machines embodying every operating convenience.

The W-55 Circular Saw has many features which make it easier to operate. The one-piece table, for example, is exceptionally large. It enables the operator to handle long stock without the bother of using extensions.

The double-faced, cast-iron rip fence can be used on both sides of the blade. Perfectly rigid and true, this fence does not have to be locked at the rear—a decided operating convenience.

This saw has a heavy, accurate, cast-iron mitre gauge. A plane-type handle makes its use much easier and safer. Stops are located at 15 degree intervals.

The safe, splitter-type saw guard pivots at two points to provide the maximum in protection and convenience. It tilts with the saw. Sawdust, which is collected within the frame, is removed from one convenient outlet.

Perhaps the most important convenience feature on this saw is its tilting arbor. The advantages of this type of saw design, however, are by now so well known and appreciated that they hardly need be repeated here.

Instructors find that the easy operation of Yates-American machines lightens the load of teaching large, wartime classes. Students need less supervision and less instruction when operating these machines of greatly simplified design.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

No. 51 of a Series

SHORT TALKS ON WOOD

CALIFORNIA LAUREL
(*Umbellularia californica*)

A beautiful, stately evergreen, sometimes known as the Oregon Myrtle. It never fails to attract attention even though it grows in a country which abounds with handsome trees. This is not the classical laurel of the ancients. The wood is heavy, hard, strong and close-grained. Rich brown in color. Has an attractive grain and takes an excellent polish.

Used mostly for furniture and wooden novelties. Considered one of the best woods for drydock blocks. The leaves contain an aromatic oil with a camphor-like odor which is used as an insecticide.

Its restricted range extends along the Pacific coast from southern Oregon to southern California. Prefers the moist, rich soil of river bottom lands.

Under favorable conditions it reaches a height of about 80 to 90 feet and a diameter of about 3 feet. In the open it has a dense, rounded crown. An attractive ornamental. Forms groves of great beauty in the canyons and mountain valleys of its habitat.

The bark is thin and scaly, and dark, ruddy brown in color. The leaves are evergreen and willow-like in appearance. Thick, lustrous, from 3½ to 4½ inches long, they are rich in aromatic oil. Bears an olive-like fruit about 1 to 1½ inches long which turns purplish when ripe. The small greenish, fragrant flowers bloom in December and January.

YATES-AMERICAN

Training Aircraft Engine Mechanics

HARRY R. WILSON*

Among the very serious shortages, which were developing even before America entered this global war, was one of skilled and fully certificated aircraft mechanics. The reasons for this shortage were several. One was the rapidly expanding aircraft industry which was far outstripping and exhausting our available facilities for the training of certificated mechanics. Another was the rigid enforcement and additional requirements of the Civil Air Regulations, stating in detail the amount of knowledge and practical experience a mechanic must possess before being allowed to assume the responsibility of repair and maintenance of aircraft in service. Still another reason was the use of increasingly larger airplanes, each one more complex and better equipped than its predecessor.

In order to make flying as safe as possible, the Civil Aeronautics Authority has very carefully and rigidly regulated the training and qualifications of those entrusted with aircraft designing, building, maintenance, repair, and operation.

This article describes a course dealing only with the training of aircraft engine mechanics or aircraft mechanic specialists, giving them sufficient required time and experience to qualify them for a C.A.A. certificate of competency. Such training will take, in its entirety, at least two years and, in a less concentrated form, three years.

There is no doubt that the postwar period will see a greater expansion in the use of aircraft for transportation of both passengers and freight than many anticipate. Already on file with the Civil Aeronautics Board are applications by scores of firms for approximately 400,000 miles of new air routes in the U. S. A. alone. The wartime decentralization and relocation of industry with its attendant shift of population is expected to cause a great increase in east-to-west and north-to-south travel with the advent of peace. We have very definitely entered the Air Age, and out of this war we will reap benefits which will make this expansion even greater than many people foresee.

Two great developments will make flying safer yet. They are the helicopter and "radar." The helicopter, by eliminating the dangers of forced landings and the necessity for long runways, will make flying a very common means of transportation. Already in the experimental stage are flying automobiles and trucks, strange looking planes that will run along the roads like automobiles and, when necessary, unfold their wings and fly cross country. "The aviation industry is ready," according to W. B. Stout, of Detroit, head of Stout Research Division of Consolidated Vultee, "with planes and trained personnel to develop peacetime air and ground vehicles on an unprecedented scale. There should be little time lag when the war ends." Radar will almost banish the possibility of midair collisions by giving us "eyes" to see through fog and darkness. With flying becoming more commonplace, it follows logically that we shall also see a greater demand for mechanics.

There is no reason to believe that the regulations governing the competency of aircraft mechanics will in any way suffer relaxation or curtailment because of postwar demand. On the contrary it is highly probable, as will be seen by reference to a proposed revision of these rules reviewed later in this article, that they will be made more comprehensive and certainly more stringent than at present. If our automobile era had grown up under such wise and strict leadership as that given to the airplane industry by the C.A.A., the black pages of death and misery written by our common daily automobile accidents would be considerably less in number and might never have been written. Uncertificated and incompetent mechanics will *not* service the helicopters and other aircraft of the future if Civil Air Regulations are strictly enforced.

In considering this prophesied lack of qualified mechanics in the future many people will point to the fact that at present we are training thousands of air mechanics in our Army and Navy Air Forces. They say that the half million men now with the air corps as mechanics will have had the training necessary to form a skilled maintenance group for aircraft in common use. That is only partially true, because in the limited time available the majority of these men are being trained as specialists in some one narrow field of aircraft mechanics work. They will return as ignition specialists, carburetion specialists, etc. As such, with further training in subjects which the C.A.A. requires for civilian mechanics, they will, upon passing the necessary practical and theoretical examination, be issued a basic aviation mechanic certificate with a rating as specialist in the type of work they are found competent to perform. An aircraft engine mechanic is required to be an *all-round* mechanic, holding the qualifications of several specialists in the trade.

Because our present and future training of mechanics and the regulation of their work is and will be strictly according to Civil Air Regulations, the basis for the organization of any mechanic school curriculum must be the C.A.R. applicable to the mechanics' work.

Present and Proposed Future Requirements for Aircraft Engine Mechanics

The Civil Aeronautics Act of 1938 is "an act to create a Civil Aeronautics Authority, and to promote the development and safety, and to provide for the regulation of civil aeronautics." The Civil Aeronautics Authority is divided into two units: one, the Civil Aeronautics Board, exercising all quasi-judicial and quasi-legislative functions according to the act, and the other, under the Administration of Civil Aeronautics, exercising all executive function. These include the issuance of airmen certificates and the examination and inspection of all aircraft, airmen, and air agencies. The Civil Aeronautics Authority is within the framework of the Department of Commerce.

One of the duties of the board is that of making regulations to promote safety in aviation. These would fill a comprehensive volume and are divided into parts. *Part 24* deals specifically with the certification of mechanics, and should be made the basis for all mechanic instruction. *Part 51* gives all regulations pertaining to the qualifications and requirements for ground instructors. *Part 53*, together with Manual 53, prescribes in detail all equipment, facilities, curriculum, qualification of instructors, and other regulations which must be provided and maintained by any civilian school aspiring to a Mechanic School Rating. The standard of instruction specified is high, requiring that 8 out of 10 of the graduates of such a school pass the mechanics' examination at the first trial, if it is taken within one year following graduation. Other standards set are such that a Mechanic School Rating would be a worth-while aim for any school course organized to train aviation mechanics.

Other regulations govern the work of a mechanic. He is expected to have a general knowledge of Part 04 (Airplane Airworthiness), Part 13 (Airworthiness), Part 16

*Aviation Instructor, Western Michigan College, Kalamazoo, Mich.; also private pilot, C.A.A. certified ground instructor with ratings in navigation, meteorology, aircraft engines, aerodynamics, structure of aircraft, instruments, radio, Civil Air Regulations, certificated aircraft engine mechanics, and parachutes; training and operations officer, Group 636, Civil Air Patrol.

(Aircraft Propeller Airworthiness), Part 15 (Aircraft Equipment Airworthiness), and Part 18 (Maintenance, Repair, and Alteration of Certified Aircraft and of Aircraft Engines, Propellers, and Instruments). Manual 18 should be in the possession of all aircraft mechanics. It contains specific instructions concerning many jobs of repair and alteration likely to be met in certificated aircraft.

At present aviation mechanic certificates have three classifications as follows: (1) aircraft mechanic, (2) aircraft mechanic (engines), (3) aircraft factory mechanic.

On September 8, 1942, the Civil Aeronautics Administration published a pamphlet entitled "Proposed Draft — General Revision of Part 24 of the Civil Air Regulations." Although many of the proposed changes may never be put into effect, the contents of the pamphlet indicate very clearly several facts. First, that the C.A.A. has recognized the specialist mechanic in aviation and he is to be certificated with special ratings for his particular line. Second, that there are several grades of mechanics and that a man may progress in his vocation step by step to higher grades and ratings. This should give added incentive to the youth who is willing to spend spare time in extra study and practical work. Third, that due to the rapid advancement in design, materials, and methods used in the repair and construction of aircraft, all experience necessary to fulfill requirements for a mechanic certificate must have been gained *within 5 years immediately preceding the date of application.*

Aviation mechanic certificates will be issued to applicants who meet all qualifications and pass the examinations prescribed for them. All certificates carry a rating record and on this is described the particular class of work or rating for which the certificate is issued. For instance, a boy may successfully meet the qualifications and pass the examination for an aviation radio specialist. He will then be issued an aviation mechanics certificate with a radio specialist rating, and will be allowed to do that class of work *only* in aircraft, unless supervised by a mechanic with a rating for the other classes of work to be done. Under the supervision of a properly rated mechanic anyone may work on aircraft, but the rated mechanic is held responsible for the quality of work performed.

Aviation mechanics will be classified "for each phase of aviation mechanics in which they are deemed competent to serve." These classifications are: (1) aircraft, (2) aircraft engines, (3) aviation mechanic specialist, (4) factory mechanic.

The holder of an aviation mechanic certificate, after being classified and rated on the appropriate airman rating record, will be graded according to his knowledge, proficiency, responsibility, and experience with respect to the particular types of equipment or specialist category pertaining to his classification in the following ascending order: (1) mechanic, (2) senior mechanic, (3) master of maintenance.

The proposed new regulations allow ample scope for progress in many fields of aviation. The categories for which aviation specialists may be rated are: (1) aircraft propellers, (2) aircraft instruments, (3) aircraft radio, (4) aircraft electrical systems, (5) aircraft hydraulic systems, (6) aircraft engine carburetion systems, (7) aircraft engine ignition systems.

An aviation mechanic specialist may hold all the above ratings, but he must hold at least one in order to gain an aviation mechanic certificate. The aircraft engine mechanic classification includes all aircraft engines and their component parts and accessories. An aircraft engine mechanic must pass an examination equal in scope to several specialist ratings, including ignition, carburetion, and propellers. It would thus be possible for a boy to progress step by step toward his engine mechanic certificate. Because this course, as outlined, is primarily for the training of aircraft engine mechanics let us look at the proposed certificate requirements in detail.

Aircraft Engine Mechanic Certificate Requirements

Age

Applicant must have passed his eighteenth birthday on date of filing application for certificate.

Character

His record must show no acts of irresponsibility or carelessness which might throw doubt upon his ability to assume the responsibilities of his position as an aircraft engine mechanic.

Citizenship

May be a citizen of any country. This assumes a world at peace. Present regulations require American citizenship with proof of unquestionable loyalty to this country, or a citizen of a friendly foreign power if such country grants reciprocal privileges to our citizens.

Education

Applicant must be able to read, write, and speak the English language. Certain limited exceptions are made to this regulation. (See sec. 24–2.)

Aeronautical Knowledge

"An applicant must have a theoretical and practical knowledge of aircraft engines and propellers, including their appliances, and be able to properly inspect, maintain, and repair the same. He must be generally familiar with the provisions of Parts 04, 13, and 14 and their manuals and thoroughly familiar with the provisions of Part 11 dealing with aircraft airworthiness and the provisions of Parts 18 and 24 and their manuals."

Aeronautical Experience

"An applicant must have had at least one year of practical experience, or what is deemed by the administrator to be its equivalent, which shall include experience with all commonly used processes, procedures, practices, tools, materials, instruments, and machinery. During such period the applicant must have performed satisfactory service in the various phases of construction, or in the inspection, maintenance, and repair of aircraft engines and propellers and their appliances. The applicant must present proof satisfactory to the Administration that the major portions of his work during such one year of practical experience, or the equivalent thereof, was of a nature and quality to properly qualify him to perform the duties and function pertaining to the type, service, and operation ratings sought. '..... An applicant must satisfactorily demonstrate by means of written, oral, and practical tests his ability with respect to the subject matters prescribed.'"

The Present Aircraft Engine Mechanics' Written Examination

The present examination consists of 300 questions of the multiple-choice type. The questions are skillfully worded and include the reading of diagrams, particularly in the subjects of ignition and carburetion. The subject matter covered presupposes the students' familiarity with *modern* equipment and materials. All six sections are graded separately, the passing grade being 70 per cent or over. In the event of failure in any one or more sections, the student may be allowed to take that one or more sections over again, or may be required to retake the whole examination. A time lapse of 30 days is required between the failure and re-examination. The following subject matter is covered in the aircraft engine mechanics' written examination: (1) carburetors and carburetion, (2) magnetos and ignition systems, (3) theory and maintenance of power plants, (4) lubrication and oiling systems, (5) propellers, (6) civil air regulations.

The practical and oral phases of the examination are usually given together, the applicant being required, under the supervision of a C.A.A. inspector, to demonstrate his skill by completing satisfactorily some job or jobs required. These *may* include any one or more of the following: (1) timing an aircraft engine, (2) reversing a magneto, (3) drilling, tapping, and filing a piece of heavy metal plate, (4) adjusting the float level of a carburetor.

The oral examination may include covering the work being accomplished, also some on trouble shooting and engine theory.

As the ultimate aim of the course is the passing of these examinations, the subjects previously listed represent the core of the curriculum. It would seem, at a glance, that the theoretical part of a mechanic's training has been overstressed and the examination has been criticized adversely by those who believe this to be so. However, modern aircraft engines and their accessories are more complex than the preaviation automobile internal combustion engines. Practical and theoretical knowl-

edge of the subjects covered by this examination is necessary for a complete understanding of the engine of today with its numerous accessories. The following outline of class, laboratory, and shopwork presents a well-balanced program.

The course, as outlined, is strictly vocational. The first year includes subjects which may be made very general in content and suitable as preparatory material for other trades such as auto mechanics, electricians, toolmakers, mechanical draftsmen, or tool designers. The second and third year is very specifically outlined for training aircraft engine mechanics and could be given during the eleventh and twelfth years of senior high school or the first two years of a junior college. Because of other required subjects in high school it would be impossible to run an aircraft engine mechanics' course concurrently with one for aircraft mechanics also. In a junior college this could be done but it would be almost a necessity for the boys to carry three semesters' work each year in order to receive adequate experience and preparation for the mechanics' C.A.A. examination.

The C.A.A. requires that in order to be eligible for a mechanic school rating the aircraft engine curriculum shall include "*no less* than 960 hours of instruction, shall be designed to be completed in not less than 20 weeks, and shall not require attendance for more than 8 hours in one day or for more than 6 days in any one week." No length of time is specified for either shop or classroom instruction. This is left entirely to the decision of the school officials. A sample curriculum is given in Manual 53, "Mechanic School Rating." Unless a student has had at least a year of preparatory work it is, in my opinion, virtually impossible to adequately train him to pass the examination in the minimum time stated, 960 hours. It would be far better to lengthen this training period to approximately 1200 hours or to thoroughly train him in one or two special subjects in the limited time available, allowing him to pass each examination as a specialist in that field, thus advancing step by step to his Aircraft Engine Mechanics certificate. Under the proposed general revision of Part 24 he might first qualify as an aviation mechanic, ignition specialist, following this by qualifying as a carburetion system specialist, and so on, until the final aircraft engine mechanics' examination was reached. This would enable one to organize a curriculum to teach a series of separate units, making it possible for a boy to take the course when attending school only part time or when carrying other unrelated subjects.

The curriculum, as outlined here, covers three years. In order to comply with the requirements of the Smith-Hughes Law, three hours per day are allowed for shopwork. Related classroom subjects cover a further one and one-half hours. Each year includes 540 hours of shopwork and 240 hours of classroom and laboratory.

The Curriculum

This covers three years. In order to comply with the requirements of the Smith-Hughes law, three hours per day are allowed for shopwork. Related classroom subjects cover a further one and one-half hours. Each year includes 540 hours in general of shopwork and 270 hours in classroom.

1st Year

Preparatory

1st Semester

1. Machine shop, general
2. Drafting and blueprint reading
3. Trade mathematics

2nd Semester

1. Machine-shop work and general welding
2. General electricity
3. Related science

2nd Year

Aircraft Engine Mechanic

1st Semester

1. Engine assembly and disassembly
2. Related science 2
3. Aviation electricity

2nd Semester

1. Engine overhaul and repair
2. Related science 3
3. Propellers

3rd Year

Aircraft Engine Mechanic

1st Semester

1. Engine maintenance and test
2. Civil Air Regulations
3. Related science 4

2nd Semester

1. Engine maintenance and test
2. Civil Air Regulations
3. Related science 5

Course of Study

Related Science 1

Purpose:

1. To acquaint the student with the names and functions of all major parts of aircraft power plants.

2. To provide an understanding of the simple theory underlying the operation and development of power in an internal combustion engine.

3. To acquaint the student with the material used in the construction of power-plant parts, the method of construction and fabrication, the heat-treatment, testing methods, and processes used.

4. To familiarize him with the different types of aircraft engines in common use.

Subject: The Aircraft Engine

A. *Aircraft-engine nomenclature:* (1) cylinders, (2) pistons, (3) connecting rods, (4) crankshaft, (5) crankcase, (6) lubrication system, (7) cooling system, (8) induction system, (9) ignition system.

B. *Cycles of operation and power output factors:* (1) two-stroke cycle, (2) four-stroke or Otto cycle, (3) definitions, (4) power, i.h.p. b.h.p., (5) thermal and volumetric efficiency (6) critical altitude, compression ratio, piston displacement.

C. *Engine design:* (1) horizontally opposed engines, (2) in-line engines, (3) radial engines, (4) supercharged and unsupercharged engines.

D. *Engine construction:* (1) crankshafts, material, construction, and theory of design, (2) main bearings, material, construction, and design, (3) connecting rods, material, construction, and design, (4) crankcases, types, material fabrication, and function of various sections, (5) induction systems, updraft and downdraft carburetors, diffuser, superchargers, (6) accessory gear trains, types of gears used, material, and design, (7) cylinders, material, construction, and design, (8) valves, material, construction, and design, (9) pistons, material, types, construction, and design, (10) piston rings, materials, construction, and types.

Related Science 2

Purpose:

1. To acquaint the student with the chemical and physical properties of lubricating oil.

2. To familiarize him with the reasons for good lubrication and the factors affecting it in aircraft engines.

3. To acquaint him with lubricating systems in common use on aircraft engines.

4. To show the application of C.A.R. to the installation of lubrication system parts, and controls.

Subject: Oil and Oiling Systems

A. *Lubricants:* (1) theory of lubrication, (2) reason for large aircraft-engine clearances, (3) temperature change effects, (4) viscosity, (5) oil strainers and filters.

B. *Laboratory tests of lubricating oils:* (1) viscosity tests, (2) gravity, (3) flash point, (4) fire point, (5) power point, (6) carbon residue.

C. *Oil consumption:* (1) factors affecting consumption of oil, (2) piston rings, (3) lubrication characteristics, (4) carbon formation, (5) oil sludge, (6) crankcase dilution.

D. *Oil temperature control:* (1) oil radiation, (2) manual and thermostatic control.

E. *Lubrication systems:* (1) pressure lubrication systems, (2) wet sump system, (3) dry sump system, (4) installation rules and general practice.

Related Science 3

Purpose:

1. To teach the simple chemical and physical properties of gasoline and other fuels used in aircraft engines.

2. To give laboratory work with gasolines and other fuels to further acquaint the student with their properties.

3. To familiarize the student with C.A.R. governing the installation of fuel systems.

4. To teach the chemistry of combustion and its application to the internal combustion engine.

Subject: Fuels and Fuel Systems

A. *Fuels:* (1) fuels used, (2) combustion processes, (3) alcohol and blends, (4) benzol, (5) petroleum, (6) gasoline.

B. *Gasoline tests:* (1) volatility, (2) vapor pressure, (3) tetra-ethyl lead, (4) knock value, (5) knock testing, (6) purity.

C. *Fuel systems:* (1) gravity, mechanical pump, pressure tank, (2) installation of lines, (3) tanks, (4) fuel level gauges, (5) pumps, (6) strainers, (7) primers, (8) pressure gauges, (9) fuel system arrangements.

D. *Carburetion:* (1) atomization, (2) function of the carburetor, (3) induction system, (4) air-fuel ratio.

Related Science 4

Purpose:

1. To familiarize the student with the parts of a simple carburetor and their functions.

2. To study the operation of a carburetor at various engine speeds and under varying conditions.

3. To acquaint the student with operation of injector type carburetors, their advantages, functioning under various conditions, and installation procedure.

Subject: Carburetors, Fuel Injection

A. *Functions of carburetion units:* (1) float chamber, (2) venturi and throttle, (3) passageways and jets.

B. *Functioning of the carburetor:* (1) idling, (2) accelerating, (3) cruising, (4) full throttle.

C. *Mixture indications:* (1) rich mixture, (2) lean mixture, (3) normal operation.

D. *Carburetor accessories:* (1) mixture control, types, (2) accelerating systems, (3) economizer systems, (4) idle cutoff.

E. *Complete operation of a standard type carburetor:* (1) idling, (2) accelerating, (3) cruising, (4) full throttle.

F. *Mixture ratio indications:* (1) exhaust gas analyzer, (2) fuel flow meter.

G. *Diaphragm and pressure injection type carburetors:* (1) carburetor icing, reasons for, (2) description of diaphragm type carburetor, (3) idling, (4) accelerating, (5) cruising, (6) full throttle, (7) idle cutoff.

H. *Injection carburetion:* (1) advantages, (2) units of injector carburetion, (3) installation, (4) operation, (5) functioning of injection type carburetors.

Related Science 5

Purpose:

1. To further the study of fuel injection systems, including servicing, installation, maintenance, and operation.

2. To promote an understanding of the theory of supercharging and supercharger systems.

3. To acquaint the student with the different types of superchargers, their operation and maintenance.

4. To study the complete operation of a power plant in service under varying conditions and speeds.

5. To formulate a system for effective and rapid trouble shooting.

Subject: Fuel Injection and Supercharging

A. *Fuel injection:* (1) light aircraft typical fuel injection system, (2) service instructions, (3) timing injector to engine, (4) removing and cleaning nozzles, (5) starting and running engine.

B. *Supercharging:* (1) reasons for supercharging, (2) types of superchargers, (3) internal gear driven supercharger, (4) manifold pressure gauge, (5) two-ratio supercharger drive, (6) two-stage gear driven centrifugal supercharger, (7) external turbo-driven, centrifugal supercharger.

C. *Power-plant operation:* (1) controls, (2) fuel system, (3) operating limits (speed, manifold pressure, temperature), (4) temperature control, (5) throttle operation, (6) mixture control operation, (7) carburetor ice, conditions and control, (8) starting, (9) warm up, (10) engine check, (11) take-off and climb, (12) cruising, (13) landing operation, (14) engine stopping.

D. *Trouble shooting:* (1) classification of failures, (2) process of elimination procedure, (3) loss of compression, (4) lubrication system troubles, (5) cooling system troubles, (6) carburetion and fuel system troubles, (7) ignition system troubles, (8) timing troubles, (9) miscellaneous causes.

Aviation Electricity

Purpose:

1. To acquaint the student with the names and functions of various types of electrical apparatus used with the aircraft power plant.

2. To give him, by means of laboratory and shopwork, practical experience in the testing, repair, overhaul, and maintenance of aircraft electrical apparatus.

Subject: Charging, Starting, and Ignition Systems

A. *Battery charging system:* (1) diagram, (2) generator, (3) control box, (4) voltage regulation, (5) current limitation, (6) cutout and field switch, (7) voltmeter and ammeter, (8) batteries, (9) operation of charging system.

B. *Starting systems:* (1) direct-hand cranking starter, (2) air, injection starter, (3) direct-electric, (4) electric inertia, (5) hand inertia, (6) cartridge type.

C. *Ignition systems:* (1) function and classifications, (2) single ignition, (3) dual ignition, (4) electromagnetic induction, (5) induction coils, (6) functions of ignition units (battery), (7) functions of ignition units (magneto), (8) firing order.

D. *Auxiliary starting methods:* (1) booster magneto, (2) impulse coupling, (3) "Hot-shot" and coil.

E. *Ignition timing:* (1) factors affecting timing, (2) staggered and synchronized timing, (3) compensated timing or "even-firing" magnetos, (4) retarded spark, (5) timing procedure.

F. *Dual battery ignition systems:* (1) function of parts, (2) operation.

G. *Dual magneto ignition:* (1) rotating magnet arrangement, (2) timing, (3) operation.

H. *Spark plugs:* (1) construction, (2) operating temperature control, (3) spark plug failures, (4) reconditioning.

Shopwork
Engine Assembly and Disassembly
(2nd Year — 1st Semester)

1. Detailed procedure and practice in the complete disassembly of engines.

2. Instruments, tools, and equipment required for disassembly and assembly of engines.

3. Progressive steps and procedure to be used in proper assembly of an engine including valve and ignition timing adjustments and tolerances used, method, procedure, and verification of adjustments.

Aviation Electricity

1. Detailed procedure and practice in disassembly, assembly, installation, maintenance, and test of generators and starters.

2. Detailed procedure and practice in disassembly, assembly, installation, and test of magnetos.

3. Ignition systems, timing and synchronization, shielding and wiring, installation, and testing of various parts.

4. Instruction in installation, maintenance, and precautions to be observed in the installation and use of batteries.

5. Adjustment, maintenance, test, repair, and inspection of spark plugs.

6. Location, installation, operation, grounding, and precaution in the use of boosters.

Engine overhaul and repair
(2nd Year — 2nd Semester)

1. Instruction in complete major overhaul.

2. Instruction and practice in the procedure of cleaning for inspection and inspection of engine parts.

3. Instruments, equipment, tools, and processes required for the proper overhaul of an engine.

4. The use of instruments for determining tolerances and wear.

5. Civil Air Regulations pertaining to replacement parts, airworthiness, proof of conformity, as applied to the overhaul of certified engines.

6. Instructions pertaining to the use of magnafluxing, its purpose, where used and procedure for use.

7. Instruction in installation of gasoline lines, basic corrections, tanks, drains and filters, including care and inspection of same.

Propellers

1. Use and care of tools and equipment, together with instruments, necessary to properly adjust, service, and make such repairs as are permissible. These shall include etching, and, when possible, magnafluxing.

2. Instruction in propeller installation and proper fitting, together with changes in installation to reduce vibrations.

Engine Maintenance and Test
(3rd Year — 1st Semester)

1. Installation of engines on test bench or in aircraft including all connections and controls.

2. Thorough instructions in starting, stopping, operation, and trouble shooting as applied to aircraft engines.

3. Construction, operation, repair, maintenance, adjustment, and inspection of carburetors.

4. Installation of carburetors. Procedure and precautions to be observed.

Engine Maintenance and Test
(3rd Year — 2nd Semester)

1. Checking and testing of an overhauled engine.

2. Trouble shooting, structural and operational failures, procedure of elimination.

3. 25-hour and 100-hour checks.

4. Carburetor troubles and failures. Corrective measures to eliminate same.

5. Instruction in operation, maintenance, repair and inspection of diffusers, blowers, and superchargers.

6. Instruction in the use of engine instruments and installation and use of controls.

Equipment

The equipment should include various types of modern American made engines, accessories, propellers, and instruments. The propellers should be of fixed wood and metal type, adjustable and fixed metal, and adjustable and controllable metal. The engines should include one horizontally opposed type (Continental, Lycoming, Franklin, etc.), one in-line type, one radial, one supercharged engine, one large radial of over 350 h.p. If possible one fuselage complete with engine mount, tanks, controls, instrument panel, and all "plumbing" (gas and oil lines) should be included and placed so that instruction may be given in installing the engine and also removing it from the plane.

Also included should be at least six magnetos of various types, six or more carburetors, pumps, and other accessories. One or two storage batteries similar to those used on modern planes should be secured. Instruments should each include three or more of the following: (1) tachometers with flexible drive to

engine, (2) oil pressure gauges, (3) oil temperature gauges.

These, together with ignition switches and throttle, mixture, choke, and magneto advance-retard controls, will be necessary for test-bench work on various engines.

Sources of Equipment

Much of this equipment can be obtained for school use through the disposal channels of the Army Air Corps. Recently the preflight training division of the Civil Aeronautics Administration was made the sole disposal headquarters for all Army Air Corps surplus and unserviceable equipment. This, though unserviceable, is modern enough to provide good practice in mechanic skills. According to a recent communication I received from Washington, application blanks for the loan and use of this equipment have been sent to state boards of education for distribution to various high schools and other public institutions of learning who may wish to include aviation training in their curriculum. If not obtainable from a state department write to: Bruce Uthus, Director of Pre-flight Training, Civil Aeronautics Administration, Washington, D. C.

Facilities

1. A drafting room with drafting tables and equipment.
2. One or more stock rooms and tool cribs to insure proper segregation of tools and materials.
3. Air pressure cleaning equipment in separate room with wash tank. Room should be adequately ventilated.
4. Room provided with test stands for "running-in" engines. Portable stands may be used if practicable.
5. Suitable space with necessary tables and benches and other equipment for the disassembly, repair, and assembly of engines.
6. Suitable space with necessary tables and benches, instruments and equipment to disassemble, repair, assemble, test, service, and inspect the following:
   A. Magnetos, generators, and other electrical equipment and power-plant appliances.
   B. Carburetors and fuel systems.
7. Suitable space and equipment for repair, overhaul, and test of aircraft engine propellers. The propellers shall be of fixed type, wood and metal, and adjustable and controllable metal.
8. One or more classrooms with facilities to adequately conduct the course. An engine should be mounted in the room with adjustable stand for class demonstration. Cutaway models of magnetos, generators, carburetors, etc., are very desirable as demonstration equipment. In place of the cutaway models accessories may be disassembled and sections mounted on a board for the same purpose. See Figure 1.

Teacher Qualifications

In order to meet both Smith-Hughes and C.A.A. requirements a teacher of aircraft-engine work must have had at least two years of *practical* experience in the trade. In order, also, that the student mechanics he is training may receive C.A.A. aircraft credit for the time spent under his supervision, the following conditions must be met. "(1) The instructor shall have, for all subjects he is teaching, a valid C.A.A. ground instructor's certificate with appropriate ratings and a valid C.A.A. aircraft engine mechanic's certificate of competency. Other persons, however, may give such instruction if under the direct supervision of a full-time instructor holding appropriate ratings and mechanic's certificate as described previously." The requirements for a ground instructor's certificate in aircraft engines are fully explained in Part No. 51 of the C.A.R. This certificate is required only when an instructor is teaching in an approved mechanics' school. However, when teaching in *any* course, including aircraft engines, holding such a certificate would be a measure of his understanding of the subject. The requirements are as follows:

"51.1 ground instructor rating and certificate requirements. A ground instructor rating and certificate with respect to any ground school subject in which a certificated flying school is required to provide instruction will be issued to an applicant who completes with the following requirements:

a) Age. Applicant shall be at least 18 years of age.
b) Character. Applicant shall be of good moral character.
c) Citizenship. Applicant shall be:
   (1) A citizen of and of unquestionable loyalty to the United States, or
   (2) A person who is in sympathy with the objectives of the United States and who is a trustworthy citizen of a friendly foreign government not under the domination of or associated with any government with which the United States is at war.
d) Aeronautical knowledge. Applicant shall have practical and theoretical knowledge of each ground school subject with respect to which he seeks a rating. Such knowledge shall be sufficient to accomplish satisfactorily a written examination thereon."

The ground instructor's examination is divided into two parts. One part tests the teaching ability of the instructor. It consists of 100 multiple-choice questions. Fifty of these are of the two-choice type and the applicant is asked to choose or rate certain teaching practices as being good and fair. Twenty-five questions require the applicant to rate teaching practices in classroom situations and the last 25 are general. They contain questions dealing with the general objectives to be accomplished in teaching this course; the development of interest, knowledge, and abilities in the students and general accepted teaching principles and practices. The second part is a determination of the applicant's knowledge of the subject matter for which the rating is sought. It contains 100 multiple-choice questions covering all phases of the subject. The objectives to be gained and the type of material covered by the examination can be determined by a study of the purposes listed in this article for Related Science 1, 2, 3, 4, and 5.

No practical *experience* is required to be eligible for the ground school instructors' examination. However, it is difficult to see how a future instructor could expect to teach a subject such as aircraft engines proficiently unless he had previously had wide practical experience in that field. Such experience might include *flying* in order to gain an appreciation of the problems involved in aircraft engine operation in the air, especially from the *safety* angle.

Methods of Teaching and Teaching Aids

There are many philosophies of teaching. Each teacher, during his experience, formulates his own and has his or her own particular methods and habits of presenting the subject and trying to make it a part of his student's life and living. Any teaching requires cooperation between the teacher and the student; they must get together on all matters pertaining to the subject being taught. Interest must be kept up because if a boy is not interested in a subject his learning is considerably retarded. In order to do this in a classroom a considerable amount of illustrative material should be used. Wall charts and bulletin boards are easily filled with subject matter pertaining to aircraft engines, drawn from magazine advertisements, manufacturers' catalogs and circuit diagrams, etc., made in the class.

The test of good teaching any *useful* subject is in the ability of the teacher to teach *it as it is used*. Aircraft engines

Fig. 1. Magneto disassembled and mounted on board for class demonstration

cannot be taught solely as a classroom and laboratory subject; the greater part of teaching must be in the shop and on engines and accessories which may be tested and probably used in service, after overhaul or repair.

To the real aircraft engine mechanic an engine is something which has life and for which he will develop a certain amount of affection when he has the job of maintaining it in excellent running condition. Therefore one of the aims in teaching this subject should be the promotion of a feeling that an engine is something to treat with care and that good care will be rewarded by good service on its part. A modern aircraft engine is even more complex and reliable than the finest jeweled watch and must be treated as such by a mechanic or a pilot.

Assembly and disassembly should be taught with a view to developing habits of systematic procedure, care in the use of tools, and care in the handling of all parts of the engine. There is a place for every part on a disassembly table and a part, if not on the engine, should be in its place. When an engine is assembled it should be examined for scratched enamel, bruised edges of nuts, and other evidences of rough treatment. The lack or complete absence of such will indicate to a great extent a good assembly job.

The Navy has a name for the careless, rough mechanic. He is called "spoiler" and his treatment of aircraft parts is shown on humorous cartoons posted conspicuously in Navy shops. Figure 2 shows two of these cartoons. No apprentice mechanic would wish to follow the footsteps and emulate the practices of "spoiler." This method of visual education can be used in school shops and it may challenge the humor and artistic ability of some member of the school art department or member of the mechanics class to produce a few cartoons similar to the "spoiler" series.

One realizes that it is almost an impossibility to have in the shops an example of each type of fuel, ignition, or lubricating system. A lot of good teaching can be done by having these reproduced either

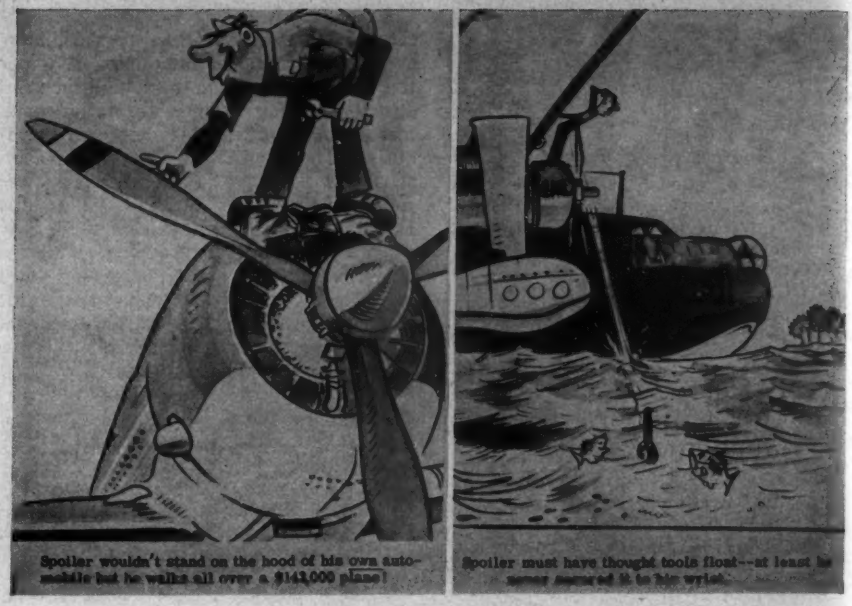

Spoiler wouldn't stand on the hood of his own automobile but he walks all over a $142,000 plane!
Spoiler must have thought tools float--at least he never learned it to his grief.

Fig. 2. Spoiler cartoons.
— Courtesy, Training Division, Bureau of Aeronautics, U. S. Navy

in the form of models or *mock ups*, or even large charts. A mock up is a model of a real system of controls or parts built up to simulate an aircraft system, in complete working order, full size or to scale. It is constructed so that the actual functioning of all parts may be seen and controlled. A mock up of an ignition system might be constructed using a magneto (electric motor driven) and spark plugs. One plug may be screwed into a heavy steel tube fitted with a tire valve, so that air may be pumped in under pressure, a pressure gauge, and a thick glass window through which the spark may be observed. Plugs may be tested and many spark plugs and other ignition parts observed and tested under simulated working conditions, using such a mock up.

For testing engines, either fixed or portable test stands may be used. These should be constructed so that the position of the tanks, controls, instruments, and accessories simulate conditions and places in the plane as nearly as possible. A portable test stand for two engines can be easily constructed using an old automobile chassis and building a framework on it. See Figure 3. This, under certain conditions, may be more useful and convenient than a fixed stand.

For disassembly and assembly of engines, adjustable stands mounted on caster wheels and disassembly tables, also movable on casters, should be constructed. See Figure 4. However, as mentioned before, the main aim of teaching disassembly is neatness and order. If no tables are available, a large sheet of heavy paper may be laid out on the bench or floor and positions marked for each cylinder and its parts, also for crankcase, accessories, etc.

One mechanic of my acquaintance had an excellent and unique method of doing this, applicable to any engine. Before be-

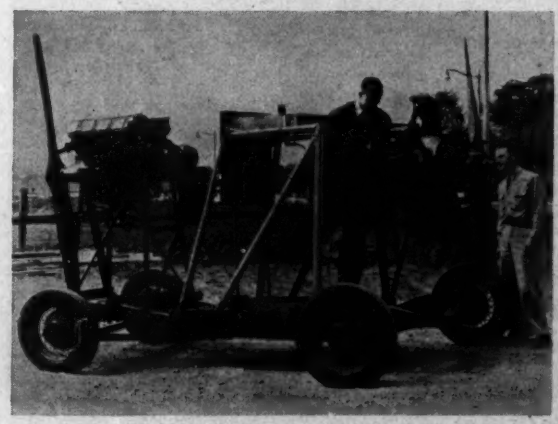


Fig. 3. Portable engine test stands. Fig. 4. Rotatable balanced disassembly stand and parts bench. Bench dimensions — 4 by 4 ft.

ginning disassembly of a strange engine, he would place a large sheet of paper on the hangar floor. This paper was marked in parallel lines labeled 1, 2, 3, etc. As each part was taken from the engine it was placed in order next to to the preceding part so that the lines in successive order were equivalent to one long line of parts. When ready to assemble, beginning at the end of the last line, each part was replaced in the reverse order of disassembly.

Cutaway models should be used in classroom demonstration and study. See Figure 5. Notebooks should be required and certain diagrams and sketches of fuel system carburetor parts, ignition circuit diagrams, etc., drawn in them carefully. The mechanic's C.A.A. examination contains questions which demand a quick interpretation of carburetion and ignition system diagrams. Sectional drawings of a carburetor are shown and the student required to name the parts. The internal circuit diagram of a magneto may be given with all parts numbered and the applicant asked to give the numbers of parts in a certain circuit.

The majority of C.A.R. examinations are of the multiple-choice type. It would be wise to use this type frequently and so accustom the student to them. The procedure used in giving this form of test is unique. In order to conserve test papers, the student is given a separate sheet of paper on which the question numbers are given with five small spaces following each number and corresponding by letter A, B, C, D, and E to the five answers. In stating the correct answers he makes a choice of one letter. If he decides that A is the correct answer, he fills in the A space with a soft lead pencil. These answer sheets are then sent to Washington where they are *machine graded*. It is possible to make cardboard cutouts for such answer sheets

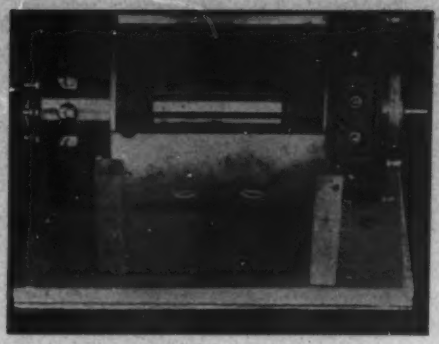


Fig. 5. Cutaway generator

and very quickly grade a large number of papers. The multiple-choice test has many advantages and is rapidly superseding all other types of tests given by various branches of the government.

Texts and Reference Material

A suitable text for *shopwork* in the course is *Aircraft Engine Maintenance* by Brimm and Boggess, published by Pitman Publishing Corporation, New York. For class discussion one could not do better than to use the *Pilot's Powerplant Manual* by T. E. Shedenhelm. This is C.A.A. Bulletin No. 28 and is for sale by the Superintendent of Documents, Washington, D. C. The author states, "the text is intended to aid in training pilots to operate the power plant properly and is not written to be used in training skilled maintenance technicians." I have yet to find a book which has such a wealth of useful, up-to-date information on the aircraft power plant and packed into so small a space. Its price is very moderate — 75 cents. This bulletin combined with a suitable shop text, similar to the one mentioned, makes an ideal and inexpensive combination.

The following government bulletins provide excellent and recent information.

1. *Technical Manual TM1-405*, "Aircraft Engines"
2. *Technical Manual TM-407*, "Aircraft Induction"
3. *Technical Manual TM-407*, "Fuel and Oil Systems"
4. *Technical Manual TM1-408*, "Aircraft Engine Operation and Test"
5. *Technical Manual, TM1-406*, "Aircraft Electrical Systems"
6. *Technical Manual TM1-412*, "Aircraft Propellers"
7. *Technical Manual TM1-413*, "Aircraft Instruments"
8. *Preinduction Vocational Training in Aircraft Maintenance, P.I.T., 333*, Published by War Department

These are also for sale by the Superintendent of Documents, Washington, D. C.

Manual 18 and Parts 04, 13, 14, and 24, and their manuals, are obtainable at the same source. These, however, should be in the possession of each student and may be, therefore, listed as texts instead of references. Several operators' manuals should be obtained for each type of engine in the shop as well as service instruction books for the various types of magnetos, generators, starters, carburetors, and other accessories: Wall charts and blueprints may be obtained with the service manuals.

Another handy reference is *Aircraft Handbook* by Fred H. Colvin, McGraw-Hill Book Company, Inc., New York.

The following magazines should be available:

1. *Popular Aviation*, Ziff Davis Publications, Chicago, Ill.
2. *Aviation*
3. *Civil Aeronautics Journal*, Civil Aeronautics Administration, Washington, D. C.

Gearing the General Shop to War Needs

G. H. BILLINGHAM*

Our general shop activities include wood turning, patternmaking, foundry practice, machine-shop practice, electrical work, machine and hand woodworking, and sheet-metal work.

In order to acquaint entering students with our equipment, shop practices, safety rules, and the like, we have a *demonstration* period during which all major units are explained. This not only gives students information regarding the shop facilities, but examples of the equipment used in various industrial fields.

*Supervisor of Industrial Arts, Weehawken, N. J.

We have mixed classes, and both boys and girls follow the same schedule. Girls are required to wear simple smocks and a protective hair covering. Two fifty-three minute periods are allotted each student per week. Checkups are held when necessary and the schedule is interrupted for short demonstrations. The method of using the sheet-metal equipment is explained as occasion arises. Mimeographed instruction sheets are distributed after, and not before, all demonstrations.

Information tests, designed to cover our equipment, are held before each marking term, one period being devoted to each of these tests.

One student with necessary qualifications is appointed to assist with minor details, such as answering the phone, meeting visitors, and for substituting during part of a period on an assignment left unfinished by an absent student.

In order to make a plan of this sort effective, the instructor should list shop equipment that can be manned, and compare it with the largest class. A greater variety of electrical problem panels, numbered in order, can be provided, and other

Part of the general shop

assignments can be varied to complete the program.

We completed our Navy plane quota last year without seriously interfering with normal shop practices. Plans were traced and blueprints made in our drafting department so that each air-minded student had a blueprint to cut up for use as a template.

Red Cross and other extra jobs are handled as far as possible by our industrial practices class. This class is made up of advanced students, featuring four shop periods a week.

Auto mechanics and drafting are taught during a Victory period.

Our general shop contains the following major units: tool cage, 3 woodworking lathes, variety molder, mortising machine, variety saw, 6-in. jointer, 30-in. band saw, foundry practice equipment, furnace, sheet-metal bench, electrical bench, metalworking bench, 3 engine lathes, 1 shaper, power hack saw, drill press, arbor press.

Demonstrations for the Entire Class

General Inspection of Shop: The tool cage; wood turning; machine woodworking; foundry practice; engine lathes; shaper; reading a micrometer, dial indicators, related inspection tools; electrical equipment; class discussion of fields covered; shop organization; shop practice.

Extras

Use of speed indicators, and their value, safety factors, sheet-metal work (curtailed because of shortage of material).

Foundry Practice

Equipment: Flask, cope, drag, sprue, gate cutter, bellows, molder's bulb, camel hair brush, sand (Albany No. 1 — about 300 lb.), Windsor locks, parting sand (nonsilica — about 5 lb. This type is approved by insurance companies. Bag to hold sand — salt bag can be used).

Trowel, hammer, slick and square or other type leveler, riddle, molding boards (2 needed), bin for sand, patterns.

Equipment for heating metal and pouring same.

Procedure:

Place drag upside down on molding board.

Place pattern with draft in proper position.

Dust with parting sand. Cover pattern with sifted sand.

Complete filling of the drag. Ram the sand as you proceed.

Level sand on top.

Place molding board on top, and turn job over.

Remove molding board which is now on top.

Place other part of flask (cope) on top. Dust with parting sand.

Place sprue in position.

Fill flask with sifted sand. Ram job while doing so.

Level top of job. Take off cope. Remove pattern.

Remove sprue. Make air holes. Cut gates. Replace cope.

Fill cracks with sand, and pour. Observe all *safety* rules.

SAMPLE CLASS ASSIGNMENT SHEET

All Assignments are subject to change without notice

Advanced Shop	Mon. and Thurs. classes--4th period																
Bliss, F.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Christiansen, C.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1
Coviello, P.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1	2
Ebneter, C.	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1	2	3
Fenkart, O.	5	6	7	8	9	10	11	12	13	14	15	16	17	1	2	3	4
Handy, J.	6	7	8	9	10	11	12	13	14	15	16	17	1	2	3	4	5
Lehfeld, D.	7	8	9	10	11	12	13	14	15	16	17	1	2	3	4	5	6
Lachmund, D.	8	9	10	11	12	13	14	15	16	17	1	2	3	4	5	6	7
Mastramano, F.	9	10	11	12	13	14	15	16	17	1	2	3	4	5	6	7	8
Miller, L.	10	11	12	13	14	15	16	17	1	2	3	4	5	6	7	8	9
Paglione, H.	11	12	13	14	15	16	17	1	2	3	4	5	6	7	8	9	10
Pipan, R.	12	13	14	15	16	17	1	2	3	4	5	6	7	8	9	10	11
Sklar, B.	13	14	15	16	17	1	2	3	4	5	6	7	8	9	10	11	12
Ufer, D.	14	15	16	17	1	2	3	4	5	6	7	8	9	10	11	12	13
Wackerling, F.	15	16	17	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Wilkins, E.	16	17	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wallachy, R.	17	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

General Shop Course

Wood Turning:

1. Straight turning with live and dead centers, tool rests, gouge for roughing, skew or turning chisel for smoothing, safe speeds, inside and outside calipers. Some work can have finish applied in lathe.

2. Faceplate turning. See that all screws are tight. Glued-up jobs. Use newspaper between glued pieces. Use of screw chucks, keyless chuck. Use *roundnose* only for roughing. Safety precautions.

Tools: Roundnose, skew chisel, gouges, parting tool, diamond point.

Do not start machine until you are sure of your procedure.

Foundry Practice: Albany No. 1 sand, parting sand, molding boards, sprue, flasks (various sizes). The cope is the top section, and the drag is the lower section of the complete flask. Hammers, spoons, leveler, wire for air holes, gate cutter, molder's brush, molder's bulb.

Patterns — Wood and Metal: Melting furnace, type metal. Lighting procedure. Turn on air pressure first, then use lighting tube. To shut off, turn off the gas first, then turn off the air pressure.

Electrical Work: Safety first. Follow directions carefully. Electrical circuits, diagrams, trouble lights, test boxes, sizes and types of wire, "BX" cable, boxes, shop problem panels, electrical chart, flat-iron parts, War Dept. "Fundamentals of Electricity."

Machine-Shop Practice: Soap or special hand protecting cream.

Engine Lathes: drives — horizontal and vertical, feeds — longitudinal and cross, compound rest, carriage, cutting, turning, machining, facing, filing. Two centers, hardest on tailstock, use white lead on dead center. Combination square center head for finding center of work. Ball-peen hammer, center punch, countersink drill, drill press. Dogs, clamp dogs, faceplate, tool post, toolholders, straight, left hand, right hand, and universal. Tool bits — high speed steel, high carbon. Cutoff tools — boring tools, boring bars, knurling tool, threading tools, center gauge, *V* blocks, surface plates, surface gauge, chucks, drill, 3-jaw universal, 4-jaw independent. Calipers — inside and outside. Micrometers — inside and outside. Scale, combination square, squarehead, center head, protractor head, drills — sizes, fractional, number, and letter.

Shaper: Speeds, feeds, ram, adjustments, tool post, cutting tools similar to engine lathe, swivel vise, carriage.

Drill Press: Speeds, adjustments, acces-

sories, chucks, key, adapters, drills, reamers, grinding devices, lapping tools.

Micrometers — Inside and Outside: Measures to thousandths — ten thousandths. Frame, anvil, spindle, sleeve, thimble, dial indicators.

Machine Woodworking: Variety saw, combination blade. Ripsaw blade. Set on teeth, hollow ground, height of blade, guards, slides, fence, pusher stick, accessories.

Jointer: Feeds — safety head, watch length of stock, safety devices.

Jig Saw: Types of blades — saber sawing, accessories, speeds.

Band Saw: Safe operation, guards.

Sander: Safe operation, belts, adjustments.

Portable Drill: Safe operation, drill bits, other accessories.

Directions for the Student

Job No. 1. Pattern lathe No. 1. Straight turning, live center, dead center, drill holes, saw grooves, use gouge to remove corners, skew chisel for smoothing.

Job No. 2. Pattern lathe No. 2. Same as for Job No. 1. Also see that operators clean machines and return all equipment.

Job No. 3. Sectional foreman No. 3. Faceplate turning. Faceplate, roundnose chisel. Practice turning. Check all aprons at end of the period. Report.

Job No. 4. Tool keeper in charge of tool crib. List all names of tool users. Replace all tools. Report before leaving shop. Turn in signed list.

Job No. 5. Sectional foreman. Foundry practice. Foreman must see that all equipment is replaced and floor section swept by student working on job No. 7, and that aprons are checked by student assigned to job No. 8. Report before leaving.

Job No. 6. Help student assigned to job No. 5. Do not pour job without permission. Observe all safety rules.

Job No. 7. Work at second bin with student working on job No. 8. After cleaning up, see that floor section is clean. Replace sand in bin and return broom.

Job No. 8. Work with student assigned to job No. 7. Check return of all aprons.

Job No. 9. Sectional foreman. Engine lathe No. 1. *This is a very responsible assignment!* Do not turn on power unless you *know your job.* Clean your machine thoroughly. Check students assigned to jobs 10, 11, and 12, and report.

Job No. 10. Engine lathe No. 2. *This is a very responsible assignment!* Sweep floor in front of engine lathes at end of period. Clean machine thoroughly.

Job No. 11. Engine lathe No. 3. *This is a very responsible assignment!* Use chuck carefully. A damaged machine has no value. Clean machine thoroughly.

Job No. 12. Shaper. *This is a very responsible assignment!* Clean machine thoroughly when through.

Job No. 13. Sectional foreman. Electrical panel No. 1. Follow directions. Look over chart. Check returns of all panels. See that all benches are clean. Report.

Job No. 14. Electrical panel No. 2. Safety first. Sweep floor around end of tool crib at end of period. Follow directions on panel.

Job No. 15. Electrical panel No. 3. Sweep floor around the windows at end of period.

Job No. 16. In cage. Tool-keeper assistant. Cooperate in maintaining high standards of efficiency.

Job No. 17. Electrical panel No. 4. Sweep around woodworking machines at the end of the period. Follow directions.

Job No. 18. Electrical panel No. 5. Follow directions on panel. Read electrical service chart.

Job No. 19. Benchwork. Assist instructor with current maintenance or extra jobs.

Job No. 20. Benchwork. Assist instructor with current maintenance or extra jobs.

Instructional Methods in Distributive Education

MURRAY BANKS*

It is not the purpose of this article to determine the relative merits of one method of presenting the subject matter over that of another method in a vocational program of distributive education. In the experience of the writer, however, several instructional methods have indicated relative values. This article, therefore, will concern itself with a subjective discussion and evaluation as to the relative success and results achieved, with the various methods of presenting the subject matter to a cooperative class in distributive education.

Methods Used in Presenting the Subject Matter

Some of the methods used to present the subject matter to the students were as follows:

1. Class discussion of problems encountered by the students in their store practice.
2. Demonstration sales by the pupils.
3. Text or reference assignments and subsequent class discussion.
4. The assignment of problems.
5. Group discussion of assigned problems.
6. Addresses by businessmen, store managers, personnel directors, and others.
7. Lectures by the teacher.
8. Demonstration sales by the teacher.

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Discussion of Problems Encountered by Students in Their Store Practice

The most common method used to present the subject matter was through class discussion of problems encountered by the students in their store practice. This method was perhaps the most practical and vitalizing of any of the methods used. Irrespective of whether the method followed is that of requiring written or oral reports, the discussion of store problems is especially worth while in training for selling activities.

After each period spent in the store, both oral and written reports were required at school. Class discussions were carried on and errors and difficulties were talked over. As an outcome of these informal periods, points which are seemingly trivial when presented to the class by the teacher come to assume vital importance in the actual business transaction. In fact, in these conferences, based on their own selling experiences, the pupils developed for themselves the underlying causes of success or failure in retail selling. Illegible penmanship, careless arithmetic, or thoughtless lack of courtesy mean one thing when listed by the teacher as causes of failure, but quite another when revealed to the student himself in terms of extra hours of work, lost sales, and disappointed customers.

Demonstration Sales by Pupils

This method deals with the practical phases of salesmanship wherein the student is criticized by the other members of the class and the teacher regarding his sales procedure and technique. Demonstration of selling in the class is conducted in the following manner. Real customers, chosen because they represent different types, buy real articles. The sale is watched by the whole class, notes being taken of strong and weak points. When the sale is finished, the one who has made the sale is allowed to criticize her own work. The

class then criticizes the sale. The customer tells why she did or did not buy the article. These demonstrations, the discussions of store experience, observations in other stores, and actual selling with thought, awaken the class to the difference between handing goods over the counter and really serving the customer.

Text or Reference Assignments

The method of presenting the subject matter through text or reference assignments and subsequent class discussions logically follows when textbooks are used. It is an adequate treatment of work which the author has discussed completely and understandably with little necessary enlargement by the teachers.

The Assignment of Problems

These problems took any one of a number of different forms, the most common one being the preparation of project books or merchandise manuals. These project books or manuals were usually patterned after some merchandise manual dealing with a particular kind of merchandise.

In order that those who are not familiar with this activity may gain some idea of the nature of these projects, an outline of the merchandise manual used by the students in the Millville High School follows:

Outline of Merchandise Manual

(*a*) Name of product. (*b*) History of the product. (*c*) Materials used in making the product. (*d*) Manufacturing processes. (*e*) Quality of product. (*f*) Durability of product. (*g*) Workmanship. (*h*) Styles. (*i*) Sizes. (*j*) Prices. (*k*) Uses of the product. (*l*) How to care for the product. (*m*) Selling points to be used in selling the product. (*n*) Other information of interest to consumers.

Compiling a merchandise manual by the students was intended:

1. To help students discover where information as to sources of materials could be found, such as in: (*a*) Libraries. (*b*) Buyers' records and reports. (*c*) Pamphlets of manufacturers. (*d*) Trade magazines.
2. To set up standards regarding mechanical details, cover, illustrations, layout, and samples.
3. To help individuals who need help and constructive criticism.
4. To evaluate the finished product.

The other methods listed are used at infrequent intervals, since methods in which pupil learning activities rather than teacher activities were emphasized were more extensively utilized.

Supplementary Methods Used in Presenting the Subject Matter

In addition to the methods listed, a number of supplementary methods were used in presenting the instruction. Among these supplementary methods were trips to stores, special merchandise reports, students' reports on merchandise research, talks by merchants, demonstrations and dramatizations by invited salespeople, reading trade journals, seeing motion pictures, reading store manuals, preparing job manuals, testing materials, and shopping reports. These supplementary methods were found to enhance the instruction and thereby make the subject matter more interesting.

Since all students were employed on a part-time basis in stores, it was possible to co-ordinate instruction with practice immediately. The curriculum in retail selling was drawn from students' experiences in stores. Although textbooks were used, many reference books, trade magazines, pamphlets, manuals, and other current publications were extensively used in the retail selling classes.

The methods which were found to be especially effective in this type of training were the discussion group method, the demonstration method, the case study method for salesmanship, and the project method for the merchandise studies.

All classes were conducted as discussion groups for at least a part of the session. The teacher would act as the leader, proposing the problem and limiting and directing the discussions. Individual instruction was also given as required to meet individual needs.

Industrial Arts for the Slow Adolescent

LOUIS G. WUST*

Providence has recognized the importance and value of teaching the mentally slow child in segregated classes so that the boy or girl may be helped to find his or her place in later life. In schools all over the country, very little help was given to the mentally slow pupil until the beginning of this century. Such a child was kept in the background — retarded in classes until he was old enough to leave school. Now it is realized by all educators that such pupils should be given special guidance, and encouraged to get the most out of their schooling. A mentally retarded boy may never become a leading figure in public life, he may never become a superintendent or *boss* of any kind; but if given half a chance at school, he can and will take his place beside others in life, and he may vote intelligently in the ruling of the people. It is proper, then, that individual assistance should be given to him.

At the present time, the city of Providence has three prevocational schools in which the adolescent boy (ages 12 to 16), who is at least two years retarded in his classroom work, may be given special educational attention. Teachers in these schools recognize the following facts concerning their pupils:

1. Mental development is slow.
2. Normal standards may be more nearly attained in physical and social rather than in mental development.
3. Home environments provide generally inadequate opportunities for constructive learning experience.
4. Hand skills are the sphere of greatest likely success for the mentally handicapped.
5. Adjustments to lifework must ultimately be made chiefly in the rank of the semiskilled and unskilled in industry.

The chief aim should be to help the mentally slow child to react efficiently as a growing child to situations, both in and out of school, and to establish habits and attitudes which will continue to operate as life goes on. The child should be given, in so far as his ability will allow, a practical working knowledge of the tool subjects, i.e., the fundamentals of reading, arithmetic, and English, including writing and spelling. The mentally deficient, much more than the normal child, must be taught to apply all the things he learns to specific situations in life, for functional use. To know how to read, how to compute numbers, how to spell, and how to write, will not suffice; it is necessary for these children to reiterate and be coached over and over again in whatever they know of each subject.

The industrial-arts teacher can do his share in this regard by encouraging the mentally retarded boy to read simple words and sentences in the shopwork; to spell out the names of some of the tools, the woods used, and the articles being made in the shop; to compute simple fractions of the inch and to calculate the number of board feet used in an article; and to write something simple and relevant to a given subject. It must always be kept

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in mind that everything must be simplified for presentation to the mentally deficient learner; and that such can only learn a fraction of what may be taught to a group of average and mentally normal junior high-school pupils.

The industrial-arts teacher should act more or less in the capacity of a guidance teacher. It is the industrial-arts instructor who usually is the only man teacher whom the mentally slow boy meets in school. A boy likes to look up to a man for an ideal —a man whom he can trust and respect, and try to imitate; this fact is especially true for the adolescent boy. He is concerned with little problems which to him, however, are large and important. He feels he cannot take these problems to the women teachers, although they may be anxious to help him; but they, by their very sex, cannot understand him as could a man. The boy realizes this in some way, and, therefore, he would like to be able to confide in his shop teacher, *if* this shop teacher shows a sympathetic interest in him. Every teacher has a definite responsibility to the pupils entrusted to his care, but the teacher of the mentally retarded is given a task and opportunity to serve the needs of those who need it most.

The teacher of prevocational classes must expect to teach by the usual methods slowed down or simplified. He must begin at the child's level and work up. The instructor must build knowledge and personality upon that which nature has given the child. These youngsters may be said to have eyes that see not; ears that hear not. Their backgrounds are meager, and they get little good from their environment. A student from such a group is often either listless or concerned with trivialities; his interest span is short, his voluntary attention is scattered, and he cannot focus his mind upon any one thing. He possesses no initiative, lacks confidence in himself, or else has the opposite characteristic of being blatantly overconfident. His mind is easily cluttered up; he cannot understand anything abstract, and he learns more readily through the hand than through the head.

The interest of such a child must be aroused; he must feel the need of knowing something. In the joy of this interest, attention and concentration of a sort may be developed. If a teacher follows up the interest cue, a learning situation arises which enables the pupil to approach that feeling of success which is so necessary for this child's mental well-being. Such a feeling of success eventually leads to a right feeling of self-confidence in facing life.

Once this interest and self-confidence have been aroused, the industrial-arts teacher, still approaching the child on his own level, can stimulate every bit of brain power which the child possesses. To do this, every bit of the subject matter must be presented to him concretely, and through as many of the child's senses as possible. In this way, learning may be made available to him.

The fundamental aim of the industrial arts in the prevocational school is to provide a means for general development and education for the mentally retarded boy. This aim may be divided into the following parts:

1. To give a broader and better understanding combined with a greater interest in the various phases of everyday life.
2. To provide opportunities for boys to make and to do the things which appeal to them and which would improve their minds.
3. To give training in and appreciation of the industrial arts.
4. To demonstrate and inculcate a knowledge of the common skills which everyone should have.
5. To provide interesting technical information about many phases of shopwork, as, for example, the use of tools — their make and manufacture; or information about woods and metals — their value and use in the shop, in industry, and in everyday life.
6. To offer a natural medium for guidance.
7. To provide organized training in reasoning and problem solving.

Pupils who are mentally retarded are not eager to listen to lectures or detailed talks on any subject. They are usually ready for action, yet they are seldom willing to wait for the preliminary demonstration. Aside from the out-and-out discipline which they must learn at any cost, they must be led carefully to accomplish things, and think at the same time. It is the function of the industrial-arts teacher to guide such pupils in the right direction. Because of the mental deficiency of these pupils, a teacher should spend only a short time explaining about the tools and the equipment of the shop. Short lectures, repeatedly given, will do the trick in most cases.

The pupil should be put to work in the shop as quickly as possible, with the minimum of preliminary instruction. His work must be most simple, but definitely active. The chief reason for this modicum of instruction is that the mentally slow cannot retain much of what is said — only that which is done. Instruction in the shop is meant to be individual, as it is needed; and, of course, it must be given frequently. The teacher moves around among the pupils, overseeing this job or that, explaining matters to this pupil or to that one. Sometimes the teacher must actually stand over the pupil doing the work at hand, so as to supervise the work from start to finish, and see to it that the job is done correctly.

The common way of imparting information to mentally deficient boys is to show them, briefly, but to the point. Demonstration serves to spur them on to imitation. Discussions which are brought about by questions in the shop are excellent means of keeping young minds alert and attentive.

Because of the necessity of frequent individual instruction, it is wise to have the prevocational classes much smaller as to number of pupils than those of a regular shop. Less than twenty pupils is the number encouraged by the more progressive schools.

Job sheets as used in the regular shop are not of very great value in the shop for the mentally deficient. Because these boys possess very little ability to read and reason things out as portrayed for them in a picture, such sheets are of little importance. However, the teacher in these classes may use very simplified sheets; in fact, he should encourage the pupil to try to figure out something simple. Such sheets must be brief; must never contain more than three or four dimensions.

Accuracy is taught by insisting upon certain dimensions. It would be ideal to insist upon nearly perfect work from everyone, but with the mentally deficient it is not possible to attain this ideal in the shop, nor should we expect it. To emphasize mechanical accuracy generally means to sacrifice interest in the work. When the boy first comes to the shop, the teacher should insist upon habits of accuracy, and when the boy sees that the teacher is determined along this line, he will try to live up to the standard set for him. More liberality is to be given handicapped boys than to those in the ordinary school shop. When the boy has done a fair job on a problem, he should be allowed to start on a new problem. Mentally deficient boys become easily discouraged; and for this reason, they should be allotted only small and simple projects; later, perhaps larger ones, but still the old simplicity and brevity.

It is a wise plan for the teacher to start all the boys on one or two similar projects; and then gradually to allow individual and free choice from pupils. The industrial-arts shop must be made interesting for the mentally retarded boy! He must feel welcome there. It must appeal to him as an inviting place. He must be there because he is eager to make something with his own hands — something which will not only please him but please others. The shop teacher should offer the boy a list of articles which he may make. It is not necessary that these articles be made from any definite plans of the teacher. By watching the boys he will see that the boys like to *think up* an idea of their own. These ideas may be suggested to them by pictures in magazines, books, or newspapers, and this manner of securing ideas and suggestions should be greatly encouraged.

Because wood is so cheap and so easy to work with, its use is to be encouraged in the shops we are discussing. Moreover, our boys can learn to utilize even discarded packing boxes, and out of these, to make many beautiful and useful articles for their homes. In the shop for the mentally retarded, wood is the principal material used.

Since such boys stay for so long a time in the shop, it is thought best by most of

the cities to bring other activities into the shop. As was said before, these boys often come from poor homes, and would like to make things to beautify their homes and to repair things which are broken or disfigured. For boys who have been in the school for more than one term, the shop should resemble a general shop.

Woodwork

Aims:

1. To teach and train boys to conduct themselves in an orderly manner as members of a shop class. To train them to receive and follow simple directions.
2. To teach the names and uses of the most common woodworking tools.
3. To teach the mechanics of using stain, shellac, varnish, hot and cold glue, pumice, polish, and the like.
4. To point out dangers and necessities for guarding the safety of one's person.
5. To teach nonabuse of tools, time, materials and school facilities.
6. To teach some of the related materials in small amounts.

Projects:

The best procedure in teaching industrial arts to the mentally deficient boy is to start him off with two definite problems. The first problem is a sandpaper block, e.g., a piece of ¾ by 2½ by 4½-in. pine. This gives the boy practice in the use of the plane, try square, ruler, ripsaw, crosscut, backsaw, and marking gauge. Sometimes the boy will have "beginner's luck," doing a good job out of the first piece of wood; but usually he must try several times before his work is successful.

The broom holder is the second project. Here again, the boy is making use of the tools he used in making the sandpaper block and becoming a little more proficient. To be specific, he shapes two pieces of wood to a given size. On the larger piece, he planes a chamfer, and drills several holes in definite places for screws. The second piece has two ends rounded either with the plane or by using a file. Then a hole is placed in the center of the piece of wood. This may either be done by using the coping saw or an expansive bit. Then, the two pieces are screwed together and sandpapered, before being shellacked or stained.

Then a list of projects is announced to the pupils. This list should be arranged in some order of difficulty but this cannot be exactly determined because the boy will select his own design or plan the new project.

List of Projects:

Doorstops	Wastebasket
Breadboard	End table
Knife and fork box	Straight chairs
Tumbling toys	Smoking cabinet
Wall shelves	Book ends
Magazine basket	Towel racks
Coffee table	Fern stand
Costumers	Birdhouses
Rocking chair	Flowerpot stand
Smoke stand	Small boats
Plant stand	Pump lamp
Matchbox holder	Swings
Reading lamp	Bookshelves
Key racks	Book trough
Tie racks	Sewing cabinet
Suit hanger	Taboret
Soapbox	Picture frames
Bracket shelf	Medicine cabinet
Footstool	Table lamp

Metalwork (Tin and Copper)

I. Purpose:

A. To make useful tin and copper articles at low cost, through educational activity directed by interest, initiative, thrift, artistic sense, and appreciation.

B. To assist pupils in developing in themselves such qualities needed for success as perseverance, dependability, patience, responsibility, skill, courage, courtesy, respect for others, and the like.

II. Tools:

A. Tin snips
B. Hacksaw
C. Spotting and planishing hammers
D. Metal files
E. Soldering copper
F. Dividers
G. Pliers
H. Jeweler's saw frames
I. Wooden mallet (May be made in the shop.)
J. Wooden blocks (May be made in the shop.)

III. Supplies:

A. Bar or solid wire solder
B. Soldering liquid or paste (flux)
C. No. 2/0 steel wool
D. Tin cans (various sizes)
E. Enamels (different colors)
F. Sheet copper
G. Copper rivets
H. Jeweler's blades

IV. Projects:

Ash trays	Index holder
Label holders	Candy dishes
Cookie cutters	Dinner bell
Measuring cup	Letter holders
Recipe box	Bracelets
Picture frames	Trays
Candlesticks	Bowls
Napkin rings	Dishes
Book ends	Shelves
Matchbox holders	Sconces
Book markers	Files
Sugar and flour scoops	Lighthouse
	Table lamp
Oil measures	Pins

Mechanical Drawing

Aims:

1. To teach the pupil that drafting is a universal language.
2. To cultivate in pupils such ideals as:
   A. Neatness and order of work
   B. Accuracy
   C. Pride and satisfaction in good work
3. To develop in the pupil initiative, originality, and self-reliance within intelligence limits.

Concrete

Aims:

1. To teach the importance of evident workmanship.
2. To teach the pupils how they may help to beautify the interior and exterior of their homes by means of concrete.
3. To teach the difference between concrete, mortar, plaster of Paris, and plaster itself.

Shoe Repairing

Aims:

1. To aid the pupils that they may make the repairs on their own shoes.
2. To show them that at little expense and with practically little effort, they may keep their shoes in repair.

Window Glass Setting

I. Aims:

To teach simple cutting and setting of window glass and glass for picture frames.

II. Tools:

A. Straight edge
B. Broad chisel
C. Putty knife
D. Glass cutter
E. Hammer

III. Supplies:

A. Putty
B. Glaziers' tacks and points
C. Glass
D. Paint

Plumbing Repairs

I. Aims:

To acquaint one with some plumbing tools and to teach something about small repairs in the home.

II. Tools:

A. Hammer
B. Monkey wrench and seat wrench
C. Snake
D. Stillson wrench
E. Screw driver
F. Knife
G. Vise

III. Supplies:

A. Washers
B. Gaskets
C. Drain cleaner
D. Sink strainer
E. Faucets
F. Nipples
G. Elbows
H. Bends
I. Unions
J. Hose couplings
K. Hose clamps
L. Rubber hose
M. Card packing
N. Joint goo

Electricity

I. Aims:

To teach elementary principles and simple repairs.

II. Electrical Symbols:

A. Push button
B. Bell
C. Buzzer
D. Battery cell
E. Ground connection
F. Wires crossing
G. Wires connected

III. Tools:

A. Hammer
B. Awl
C. Screw driver
D. Insulated pliers
E. Knife
F. Soldering copper
G. Fuse pliers

IV. Supplies:

A. Plugs, male and female, different types
B. Wire: strand, solid, and gauges
C. Sockets
D. Switches
E. Soldering wire, flux
F. Electrician's tape
G. Fuses

V. Projects:

A. Vibrating electrical bell
B. Wiring attachment caps to extension cords
C. Repairing appliance cords
D. Cutting insulation
E. Cleaning wires
F. Tightening and fastening wire ends
G. Splicing wires
H. Replacing blown fuses
I. Reading meters
J. Making electric magnet

What so deadening as the certainty of events! What so opposed to our knowledge of learning as the dead-set management scheme! — *Homer J. Smith.*

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

A Fitting Memorial

On September 2, 1943, Dr. William F. Rasche, director of the Milwaukee Vocational School, and his wife received the sad message that their oldest son, William Jr., had lost his life when the vessel on which he was serving was torpedoed in the Mediterranean.

Mother and father realized, of course, that their son had sacrificed his life for a great cause, and that the sons of many parents will have to make the same sacrifice before this war is over. Yet it filled them with sadness to think that their son, who had majored in sociology at the University of Chicago, would now have no opportunity to put into execution the plans for his future which he had discussed with them.

Then came the inspiration to the sorrowing parents to raise for their son a living monument, by making a gift of a memorial library consisting of approximately five hundred books chosen from the various areas comprising the field of the social studies, to the Milwaukee Public Library. Their plan also included an endowment, the proceeds of which is to be used for adding new books to keep the collection up to date.

These bereaved parents have set up for their son an imperishable monument. Their generous gift has made it possible for him to assist future generations of young students, interested in the very subjects which he had liked so much, throughout the existence of Milwaukee's Public Library. William Rasche, Jr., will continue to live through the lives of those who have had their lives influenced by the memorial library established in his memory by his parents.

How is Your Testing Program?

With the end of the first semester of the school year 1943–44 in sight, it is time to think about how to appraise the work which students and teachers have accomplished so far. This means that some kind of measuring device has to be applied, both to the practical things produced in the shop, and to the lesson material worked out by the students in the related subjects material.

Teachers of shop subjects have long been accustomed to apply rigid methods of scrutiny and measurements to finished articles of their own manual skill. It is somewhat difficult to understand, therefore, why some are so reluctant to make use of scales and tests in checking up and measuring the final results of their educational efforts on their students.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION has published an annual average of twenty tests and articles on testing during the past five or more years, and it will take but little effort in most cases to cull enough test items from these published tests to satisfy the needs of almost any shop teacher.

Of course, there are standardized tests of many kinds available, and most of these can be obtained at a reasonable cost, but many teachers like to write their own tests, and a selection of items from the tests that have appeared in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION may be made with ease and rapidity. In this way the teacher can produce tests of many kinds, and he can make them fit his own particular needs.

Some teachers find the tests published in the magazine very useful, while others criticize them because they do not fit a particular type of work being offered, or because the test items are too easy or too hard. However, the published tests serve a very valuable purpose if they do nothing else than to spread the use of testing among more shop teachers.

For those who want to know more about test construction, a perusal of "Construction of Written Achievement Tests" by William J. Micheels and M. Ray Karnes, which appeared in the September and October, 1943, issues of this magazine would be quite helpful. This article describes quite explicitly just what points will have to be observed in constructing the various types of tests, such as the alternate response, cluster true-false, modified true-false, multiple-choice, matching, classification, identification, listing or enumeration, correct order or rearrangement, completion, controlled completion, and situation type.

As already mentioned, the time for giving midyear tests and exams is approaching. It is now time to prepare the tests. Use those published in the magazine if you can. They have been put there for that purpose. But if these tests do not satisfy your needs, by all means prepare some that do. Then apply them when the time comes and do something about the test outcomes. It is only by using tests in this way that courses and the result of courses upon students can be changed for the better.

Infantile Paralysis Campaign

The 1943 infantile paralysis epimedic claimed approximately twelve thousand victims, men, women, and children. Most of those stricken were under 10 years of age.

Every effort should be made to help those who are working toward the abolition of this dread disease, and for this reason shop instructors can render real altruistic service by doing their utmost to make the "March of Dimes" from January 14 to 31 a real success.

Know Your Fire Extinguisher

Many school shops are equipped with fire extinguishers, but few of these presumably protective devices are regularly inspected. What is more, few of the teachers know much about the composition contained in their fire extinguishers, or know how to protect them at subzero temperatures.

The Safety Research Institute, Inc., of New York City, advise that soda-acid, foam, and gas cartridge extinguishers must not be subjected to temperatures of lower than 40 deg. F. Some of these extinguishers can be protected against lower temperatures by adding antifreeze chemicals supplied by the manufacturer. Chemicals other than these should never be used as they may change the nature of the contents, or corrode the parts of the extinguisher.

Extinguishers charged with vaporizing liquids, carbon dioxide, or the loaded stream types do not require any protection against freezing.

No matter what type of extinguisher is in your shop, inspect it, recharge it if necessary, and above all, know how to use it.

Locker plant of Holtville Consolidated School, Holtville, Ala.

A School Operated Locker Plant

GEO. H. WATSON*

A quick-freeze locker plant to serve as a model for the community and as a study project for the pupils is operated by Holtville Consolidated School, Holtville, Ala., which is located in Elmore County, some 25 miles from Montgomery.

This school, located as it is in a strictly agricultural community, has as one of its functions to show the way to better living for farm families, according to Prof. James Chrietzberg, principal. Hence, it is quite vocational in its nature, and has a number of projects besides the locker plant, including a canning plant, a chick hatchery, and a printing plant. Students, in operating these projects, learn while they work, and at the same time carry the story of improved methods into the community.

The locker plant has 100 lockers with space for more as needed, and also includes facilities for smoking, curing, salting, and refrigerating pork. While not planned as a profit venture, the lockers are readily rented to patrons in the community and are operating to capacity.

The locker plant is a laboratory where pupils learn the principles of refrigeration and of dressing, cutting, curing, and packing meat products. During the fall season the plant was worked day and night to take care of the processing of pork and beef products.

Through these students, the homes learn about improved methods of handling, storing, grading, packing, and refrigerating meat, poultry, poultry products, fruits, and vegetables.

Besides this the vocational agricultural teacher, J. R. Formby, goes into the community, visits farm homes, and consults with families as to how they may improve their methods. He also holds meetings at the school from time to time to discuss these subjects.

The school locker plant, therefore, serves in a double way. It not only offers a service to the community, but serves as a laboratory for the students who show exceptional interest in its operation. While farm locker plants are quite numerous in the Middle West, the idea is just now beginning to spread in the South, where the blessings of refrigeration are needed even more on account of the longer summer season.

The school has gone further than other locker plants, because it raises its own vegetables and its own pork, so that it offers its students opportunity for extensive experimentation.

The refrigeration equipment is of sufficient size to permit expansion of the plant to 200 to 300 lockers if desired. This includes one Frick 3 by 3 VSA enclosed type ammonia compressor, driven by a 5 h.p. motor for operation on the low temperature rooms (which includes the locker storage section where a zero temperature is maintained) and the sharp freezing room (where a 10 deg. F. is maintained). Besides this there is a Frick 3 by 3 VSA enclosed type ammonia compressor, driven by a 3 h.p. motor for operating the high temperature rooms, which include the chill room and the salt meat room, both of which operate at an average temperature of 36 deg. F.

Both machines pump into a common condenser, a Frick 18 by 50-in. vertical shell and tube ammonia condenser.

Freezer coils containing the refrigerant are located against the ceiling in the rooms and fans are used to circulate the air over the coils and through the rooms. This arrangement permits more room for storage and eliminates the necessity of defrosting the coils, since the frost is blown off the coils as formed.

*Birmingham, Ala.

INDUSTRIAL-ARTS OBJECTIVES

1. *To develop skill in the use of common tools.* For the home, avocational purposes and general preliminary training.

2. *To afford industrial information and social intelligence.* For a better understanding of materials and processes of manufacture, the economic and social value of labor and the conditions and problems of industrial employment.

3. *To foster appreciation of good materials and workmanship.* To secure intelligent selection of manufactured products for home and business.

4. *To further intelligent choices of life occupations.* For wider knowledge of the requirements of industrial jobs, to understand better individual capacities.

5. *To inculcate worthy personal traits and attitudes.* For acquiring habits that will help to bring success in life.

6. *To provide a measure of specific occupational training.* For promoting an easy entrance into work wherein a living can be earned. — *Homer J. Smith.*

All things are cheap to the saving, dear to the wasteful. — *Benjamin Franklin.*

Course Outline in Related Social Studies

H. BOODISH*

Objectives in Related Social Studies

I. An understanding of the complexity of modern society and an appreciation of the role played by various social and economic groups (labor, industry, business, agriculture, and consumer) in maintaining its well-being.

II. An understanding of the interplay of economic and social forces in the growth and development of American democracy.

III. An understanding of the various phases of our economic system; the nature and means of production and distribution; the character and type of business organizations; the nature of our banking and monetary system; the nature and causes of industrial strifes, etc.

IV. An understanding of the influence wielded by various types of pressure and lobbyist groups (economic, social, political, and religious) upon government operations (federal, state, and local).

V. An understanding of the role played by outstanding personalities, past and present, in molding our economic, social, and political life, with the view of encouraging emulation of those qualities that tend toward the betterment of our ways of life.

VI. An understanding of the influence wielded by agencies of communication (newspapers, magazines, books, radio, and the motion pictures) with the view of developing sound judgment and critical analysis.

VII. An understanding of the various economic and political philosophies, past and present, impinging upon our economic and social life.

VIII. An understanding of the economic and social forces, past and present, that caused the development of, and affect present changes in, our institutions of private property, family, marriage and divorce, religion, penal institutions, etc.

IX. An understanding of the changing role of government in our economic life with the view of fostering on the part of each individual, of whatever occupation, an interest in active participation in the duties of citizenship.

1. OUTLINE OF COURSE OF STUDIES IN RELATED SOCIAL STUDIES

Term I

Society at Work (Economic Aspects)

Unit 1. *Making a Living Before the Industrial Revolution*
- A. Hunting and fishing stage
- B. Pastoral stage
- C. Agricultural stage
- D. Early trade and commerce

Unit 2. *The Industrial Revolution — Change From Hand to Machine Production*
- A. Nature and means of production before the Industrial Revolution
  1. Domestic system of manufacturing
  2. Primitive methods of production
- B. Factors favorable to change
  1. Development of commerce
  2. Favorable position of England
- C. Conditions following the Industrial Revolution
  1. Development of the factory system
  2. Development of steam engine and water power
  3. Expansion of commerce
  4. Expansion of Industrial Revolution to agriculture
- D. Advantages and disadvantages of Industrial Revolution
  1. Mass production
  2. Higher standard of living
  3. Problem of slums, etc.
  4. Business cycles

Unit 3. *Nature of Business Organizations*
- A. Simple single enterprises and partnerships
  1. Advantages and disadvantages
- B. Corporations
  1. Characteristics of
  2. Advantages and disadvantages of
  3. Nature of mass production
  4. Organization of
     - *a*) Stockholders
     - *b*) Board of directors
     - *c*) Management
- C. Trusts and holding companies
  1. Monopolistic character of
  2. Government attitude toward monopolies
     - *a*) Legal monopolies
     - *b*) In opposition to Sherman Anti-Trust Act
  3. Present aspect and future tendency
     - *a*) N.R.A.
     - *b*) Place of small business
- D. Government regulation of public utilities
  1. Nature of public utilities
  2. Federal action
  3. State action

Term II

Society at Work (Economic Aspects) — Part 2

Unit 1. *Monetary and Banking System*
- A. Nature and use of money
  1. As a means of exchange
  2. As a medium of credit
  3. As a standard of exchange
  4. As a standard of credit
  5. Early forms of money
- B. Development of our banking system
  1. First and second national banks
  2. Banking Act of 1863
  3. The Federal Reserve system
  4. The banking crisis of 1933
  5. Federal Deposit Insurance Corporation

Unit 2. *Communication and Transportation*
- A. Our dependence upon transportation
  1. Specialization in production
  2. Interdependence of different geographic areas
  3. Facilitate exchange of commodities
  4. Effect upon standard of living
- B. Effect of transportation upon the development of our nation
  1. Helped in westward expansion
  2. Helped to unify it by bringing people closer together
  3. Contributed toward interchange of ideas
- C. Growth of transportation
  1. Natural waterways, turnpikes, canals
  2. Coming of railroads
  3. The steamboat
  4. Coming of the automobile and truck
  5. The airplane and the future of the airways
- D. Government regulation of
  1. Interstate Commerce Commission
  2. Office of Defense Transportation
  3. Government ownership *v.* public ownership
- E. Development of communication
  1. Evolutionary growth of different means of communication
- F. Dependence upon communication
  1. In time of peace
  2. In time of war
- G. Present problems
  1. Freedom of the press
  2. Advertising and radio
     - *a*) Favorable features
     - *b*) Unfavorable features
  3. Newspapers, magazines, radio, and movies as propaganda agents
     - *a*) In times of peace
     - *b*) In times of war
     - *c*) In political campaigns

Unit 3. *Consumer Problems*
- A. Need for consumer education
  1. Complexity and variety of products produced
  2. High pressure advertising
- B. Government action
  1. Food and Drug Act
  2. Government inspection of meat
  3. Regulation and inspection of weights and measures

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C. Cooperative movements
   1. Nature of
   2. Advantages and disadvantages
D. Consumer problems in wartime
   1. Rationing
   2. Wise buying

Term III

Organized Labor and Labor Problems

Unit 1. *The Rise of Organized Labor*

A. Factors responsible for the development of labor unions
   1. Industrial Revolution which gave birth to the factory system and created a new class of people — factory workers
   2. Working conditions in factories
      a) Low wages
      b) Long hours
      c) Unhealthy and dangerous working conditions
   3. Weakness of the individual worker to bargain for better working conditions and recognition by him that collective bargaining was a stronger weapon
B. Historical sketch
   1. Early period — 1820 to about 1860
   2. Effect of economic conditions (business cycles) upon union membership
   3. Attitude toward immigration

Unit 2. *Types of Labor Organizations*

A. The Knights of Labor
B. The American Federation of Labor
C. The Industrial Workers of the World
D. The Congress of Industrial Organization
E. Other labor organizations

Unit 3. *Weapons Employed by Employers and by Labor*

A. Employers' weapons
   1. The lockout
   2. The black list
   3. The "yellow dog" contract
   4. The injunction
   5. The company union
   6. Strike breaking
B. Weapons of labor
   1. Collective bargaining
   2. The strike
      a) Ordinary
      b) General
      c) Sympathetic
      d) Sit-down
   3. The boycott
   4. The union label
   5. Unfair lists
   6. The closed shop
   7. The preferential shop
   8. The checkoff

Unit 4. *Present-day Labor Problems and the Future of Labor*

A. Organized labor and labor legislation
   1. Norris-La Guardia Anti-Injunction Act
   2. Welsh Healy Act
   3. Fair Labor Standards Act
   4. Wagner Labor Relations Act
B. Peaceful settlement of labor disputes
   1. Direct negotiation
   2. Conciliation
   3. Mediation
   4. Arbitration
      a) Voluntary
      b) Compulsory
C. Labor racketeering and other unfavorable aspects of the labor movement
   1. High initiation fees
   2. "Protective associations"
   3. Restriction of output
   4. Irresponsible leadership
D. Labor in politics
   1. Lobbying and pressure tactics
   2. Labor unity
   3. American Labor Party and Labor's Non-Partisan League
E. Labor and the war
   1. The War Labor Board
   2. Wages and inflation
   3. Strikes

Term IV

Present-Day Economic Problems

Unit 1. *The Business Cycles*

A. Characteristics of
   1. Depression
   2. Recovery
   3. Prosperity
B. Causes of
   1. Overproduction
   2. Misdirected production
   3. Under consumption
C. Effects upon society
   1. Periods of unemployment
   2. Want amidst plenty
   3. Dangers to political stability
   4. Demoralizing effect upon young people

Unit 2. *Safeguards Against Economic Disaster*

A. Government planning as a means of eliminating business cycles
   1. Arguments for
   2. Arguments against
B. Social security
   1. Old age insurance
   2. Aid to dependent children
   3. Blind pensions
   4. Unemployment compensation
   5. Workmen's compensation
   6. Health insurance
C. Meeting the problems of unemployment
   1. Public works
   2. Unemployment relief
   3. Unemployment compensation
D. Private insurance
   1. Life insurance — types of policies
      a) Endowment
      b) Industrial
      c) Ordinary
   2. Accident and health
   3. Hospitalization plans

Unit 3. *Conservation of Natural Resources*

A. Need for conservation
   1. Effect upon national development
   2. Dependence upon
   3. Previous wastage of and its effects
B. Conservation movement — Historical sketch
C. What must be conserved
   1. Forests
   2. Minerals
   3. Water
   4. Soil

Unit 4. *Conservation of Human Resources*

A. Prevention of disease and accidents
   1. Factors contributing to industrial disease and accidents
   2. Government regulation and inspection
   3. Child labor and school attendance laws
B. Housing and slum clearance
   1. Causes of slums
   2. Evil effects upon society
   3. Elimination of
      a) Private endeavor
      b) Cooperative endeavor
      c) Government or public housing

Term V

Government and Our National Economy

Unit 1. *The Effect of Economic, Political, and Social Forces Upon the Development of Government*

A. Recognition by man that some superauthority is needed to protect him and his family and his belongings (property and other forms of wealth) while he goes about in his economic pursuits
B. Early forms of government were simple in form — reflecting the simplicity of economic and social life. For example, tribal and patriarchal forms of governments in pastoral and primitive agricultural stages
C. In time governments increased in complexity reflecting the increased complexity of our economic, social, and political life — particularly following the industrial revolution
D. Democratic government became possible when the social economy offered greater leisure time and extended opportunities for education

Unit 2. *Present-Day Functions of Government and Future Trends*

A. Laissez-faire policy *v.* increased government regulations
B. Economic theories of government
   1. Capitalism and the profit motive
   2. Socialism
   3. Communism
   4. Fascism
C. Analysis of present-day functions of government

Unit 3. *Meeting the Costs of Government*

A. Sources of government revenue
   1. Tariffs — kinds of
   2. Internal taxes
B. Kinds of taxes
   1. Income
   2. Sales
   3. Excise
   4. Inheritance
   5. Pay-as-you-go
   6. Spending
C. Advantages and disadvantages of each under B
D. Theories of taxation
   1. Justification of
   2. Ability to pay
   3. Evasion of
   4. Cost of collection
   5. Enforcement

Unit 4. *The Role of Political Parties in our Economic Life*

A. Early economic forces that gave birth to the American biparty system
   1. Agrarian economy of Jefferson *v.* trade and money economy of Alexander Hamilton
   2. Tariff as a political football
   3. The cotton south and the Negro issue

B. Later economic forces and the party system
   1. The tariff
   2. The silver question
   3. The populists of the west
   4. Extension of suffrage — removal of economic and social restrictions
   5. The influence of European radicalism

C. Present problems
   1. The "spoils system" and Civil Service
   2. Party conventions and elections
   3. Party operations

Unit 5. *Economic Forces and International Relations*

A. Factors contributing toward cooperation
   1. Free trade and tariffs
   2. The Monroe Doctrine
   3. The League of Nations
   4. The Atlantic Charter and the Four Freedoms

Term VI
The Growth and Development of Democratic Government in the United States

Unit 1. *Factors That Led to the Colonization of America and Which Influenced the Development of Democratic Government*

A. Economic
   1. Desire to establish trade with the East Indies
   2. Desire to reap riches (gold) discovered by the Spanish
   3. Desire on the part of certain groups of people to escape economic poverty at home
   4. Development of large trading companies
   5. Influence of Mercantile theory

B. Political-Economic
   1. Desire to escape political persecution at home
   2. Granting of sections of land for colonization to individuals in payment for debts by King of England
   3. Recognition that colonies would strengthen another country both politically and economically

C. Other factors
   1. Desire to escape religious persecution
   2. Spirit of adventure
   3. Desire to escape penal servitude

Unit 2. *Factors Within the New World Favorable Toward the Development of Democratic Government*

A. Geographic position of the United States kept it distant from political bickerings of Europe

B. Availability of almost unlimited opportunity to acquire land bred a free and independent people — essential to democracy

C. Pioneering life emphasizes ability to work and disregards old-time class distinctions and prejudices

D. Presence of unlimited natural resources made possible early industrial development

Unit 3. *The American Revolution*

A. Factors favorable to a breakaway from England
   1. The economic forces controlling the English government
   2. The nature and make-up of the American colonist the presence of more than just English stock
   3. Economic differences arising between England and the American colonies
   4. The series of laws passed by the English government hampering development of American trade and manufacturing
   5. The nature and make-up of Colonial governments
   6. Economic dependence of Colonial officials upon Colonial assemblies
   7. Influence of economic and political theorists, such as Voltaire, Paine, Jefferson, etc.

B. Landmarks in the American Revolution
   1. The Boston Tea Party — its economic effects
   2. The Battle of Concord
   3. The first and second Continental Congress
   4. The Articles of Confederation
   5. Declaration of Independence
   6. The economic difficulties confronting Washington
   7. The financial difficulties facing the colonies

Unit 4. *The United States Constitution*

A. Economic chaos that followed the peace treaty
   1. Currency problems
   2. Tariff problems
   3. Interstate trade problems
   4. Weakness of Articles of Confederation

B. Economic and political forces that helped shape the Constitution
   1. Problems of small and large states
   2. Problems of representation of Negroes
   3. Influence wielded by forces representing the agricultural and agrarian interests
   4. Influence wielded by forces representing mercantile and financial interests
   5. Alexandrian philosophy *v.* Jeffersonian philosophy
   6. Effect of property qualification for voting

C. *What the Constitution Means and What It Stands for*
   1. The Bill of Rights
   2. States Rights *v.* Federal Control
   3. Amendments and changing social needs
   4. Judicial review
      a) Under John Marshall
      b) Under Jacksonian agricultural rule
      c) Under Lincoln
      d) Under Roosevelt

A REINTERPRETATION OF INDUSTRIAL-ARTS OBJECTIVES

CHARLES P. RICHARDSON*

All educational practices are subject to change, but probably none more often or more radically than those of industrial arts and vocational education. This is due to the dynamic characteristics of our technological American culture. We must keep pace with the changes in our occupational world if we are to provide the skills and knowledges needed to provide this industrial civilization with competent workers and understanding citizens.

We are faced with the immediate problem of training for the war industries and, concurrent with this, the task of readying all of our young people for a rapid entrance into and participation in an age in which aviation will play a profound part in the economic, political, and social lives of all our people.

As soon as the war is over we will be faced with the task of retraining and rehabilitating thousands of men and women now in the armed forces and in industries.

To accomplish this means that we must constantly be in a position to adapt our educational programs to the problems at hand and those pending in the not too distant future. We must, therefore, constantly reinterpret our stated objectives in terms of these needs if we are to make our training and retraining effective.

The following is a reinterpretation of the objectives stated in "Standards of Attainment in Industrial Arts Teaching"[1] compiled in 1934 by a committee of national leaders in industrial-arts education. These objectives have been recognized as basic foundations upon which any curriculum in industrial arts could be written. All that is needed to adapt a new program to present needs is to interpret these objectives in terms of those needs. This article proposes to show how this can be done to fit our present circumstances.

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[1]Industrial Arts Section, American Vocational Association, Incorporated, December 7, 1934.

Objective No. I

"To develop an active interest in industrial life and in methods of production and distribution."

1. We should not go far afield. Confine the study for the present to industries represented in the local area. If we do this properly, we will have met this objective satisfactorily. Therefore, *concentrate* on filling the needs of industry in your community, if possible.

2. Call on specialists from local manufacturers — co-ordinate the teaching of industrial arts with the industries in such things as manufacturing process, production methods, distribution, employment problems. *It is just as important to co-ordinate in this field as it is in the field of trades and industries.* The boys and girls of today will be employees in these industries in the very near future. *Cooperate and co-ordinate now* with your local war industries. We can find out how to make hats and automobiles and ice cream later.

3. Study the sources of raw materials, critical materials, replacement materials, new developments and inventions.

4. Methods of distribution; what is coming up in the air transportation; a field that is brand new and wide open to all kinds of vocational expansion.

5. The working quality of materials in use — how are they being changed. For example, new coding of steels due to lack of chrome, molybdenum, tungsten, etc., and the effect it will have in the entire construction industry. Use of woods and plastics in place of metals. There is not an industrial-arts shop which could not make such a study profitable.

6. Commercial sizes, grades, classifications, and sales units in common use. Revise these lists to include Army-Navy specifications, new products on the market. Have on hand magazines on processes and materials and on production methods. Weed out nonessential information, re-evaluate all lists, get them up to date. The material in use last year may be quite different today.

7. *Counsel:* If the instructor cannot counsel on new conditions, labor relations, requirements, and opportunities, cooperate with specialists in industry for this counseling. It is dollars and cents in their pockets to help us. Counseling and guidance meetings should be held, not once a year, but once a month, and more often for the smaller groups.

8. Form advisory committees of laymen from trades and industries similar to the trade advisory committees for vocational education. Criticism of our present educational practices would not have occurred if we had followed this practice in the past.

Objective No. II

"To develop the ability to select, care for, and use properly the things he buys or uses."

1. For the duration of the war this objective has special significance for boys and girls training in the mechanical field. Care and use of tools and materials which cannot be replaced, must be given close attention. Likewise consideration of substitution of materials for the school shops must be given, i.e., construction and layout on cardboard instead of sheet metal, use of wood salvaged from boxes instead of plywood, and many other such devices must of necessity be adopted. Ingenuity and initiative are going to be the criteria for the successful industrial-arts instructor in the near future.

2. Correlate instruction with the core curriculum in the purchase and use of materials. Cautioning on the need for thrift now to provide a "cushion" for the postwar depression, and many other items of economic importance can be used to make industrial-arts teaching more significant.

Objective No. III

"To develop an appreciation of good workmanship and good design."

1. Give more emphasis to this in terms of what good workmanship means in an *Air Age*. There cannot be such a thing as *good enough* in aircraft; *perfection* is vital. An automobile can stall without serious consequences; an airplane cannot. A fraction of an inch off does not matter much when only one part is being made; it means thousands of dollars when thousands of parts are made, or thousands of men are concerned.

2. Appeciation can come only through well-informed judgment, based upon adequate comparison. In order to appreciate good workmanship, one must have an opportunity to compare good and bad workmanship and know the elements upon which such a classification is made. Insistence must be made on *perfection* in terms of the individual's ability to perform. This means a revision of our present mode of operation where we have allowed advanced work to be judged according to substandards. The success of good administration in industry depends upon the executive's ability to place workmen on jobs according to their ability to perform to the standards required by the industry. Reconsideration of contents and methods to accomplish the same thing in industrial-arts shops is essential.

3. Valid judgment with the respect to design can be developed only through a knowledge of the principle of design, and an opportunity to observe and compare the application of these principles in many situations. To emphasize this observation as it may apply to the revision of the industrial-arts curriculum, it may be shown that designing can be applied now for utility rather than for aesthetics. Both are necessary in the complete education of the individual, but there are times when one can be emphasized more than the other. A case might be cited in the *Jeep*, surely not a "thing of beauty and a joy forever" but strictly an item of utility.

Objective No. IV

"To develop an attitude of pride or interest in his ability to do useful things."

1. If ever there was a time when this objective can be met fully, it is now. Pride in one's ability to do useful things is one of the best guarantees of good citizenship. It can be acquired only through successful accomplishment, and every pupil should be trained until he can do well at least a few things. One likes to do the things he does well, and a distasteful task in learning may become a pleasure in accomplishment. It should not require any supersalesman to induce boys and girls to do useful things in the (1) service of their country; (2) service of their home; (3) service of their community; (4) service of themselves or other individuals.

2. Projects such as model aircraft building for the Navy, stretcher building for the Red Cross, production building of parts for maintenance of the school plant, and many other projects should be done with a willingness to serve and to sacrifice — with a spirit of selflessness in a great cause. It should not be necessary to depend upon the building of personal goods to maintain interest in the shopwork. Neither is it necessary to approve poor work and low standards of accomplishment in order to maintain interest. The contagious enthusiasm of the instructor for the work to be done is the most vital part of this program. Without the enthusiastic interest of the instructor the program is doomed to failure. Standards of perfection must be held for teachers as well as students, and foremost among these standards is the willingness to perform.

Objective No. V

"To develop in each pupil a feeling of self-reliance and confidence in his ability to deal with people and to care for himself in an unusual or unfamiliar situation."

1. This involves a feeling of mastery over material things and a belief in his ability to modify or adjust them to meet his needs, as well as the ability to meet people successfully in social and business intercourse. The more extensive the experience, the greater the confidence in one's ability. Adequate opportunities must be given in a systematic way through a definite program and the training not left to chance or accidental contacts.

This ability can be developed through:

1) Familiarity with machines and how they operate.
2) The ability to use common tools and materials sufficiently well to meet emergencies.
3) Examining a problem to see what is required before beginning it.
4) Learning to plan and execute problems on one's own responsibility.

5) By transacting business.
6) Meeting people in social and business intercourse.

2. Many new machines are now in use the operation of which is based upon the fundamental characteristics of machines which are common to the school shops. Particularly is this so in the machinist trades. It must be a duty of education to acquaint the students with these machines and the basis upon which they are founded. This is necessary due to the job simplification taking place within industry. The chances are that not one in a hundred of the mechanics going into industry will be required to know the operation of a number of machines. He will be a machine operator. He will, however, be required to know the basic principles involved in the operation of each machine if he is to be able to change jobs with a minimum of training. Industrial-arts men would do well to stock their libraries with every kind of manufacturer's catalogue dealing with tools and materials in their field.

3. It has been found that fundamental tool skills involving co-ordination of muscular activity are readily transferable from one field of work to the other, even though the trades may be far apart. This is especially significant and differs greatly from our past notions; therefore, stress must be put upon manipulative operations in every shop. The truth of this statement can be had in the survey of the industries in Milwaukee; by the survey of 5000 industrial plants last year; and from statistics obtained from the training within industry program, it is shown that better than 50 per cent of the employees in the production trades can learn their work in less than one week.

Objective No. VI

"To develop the habit of an orderly method of procedure in the performance of any task."

1. This objective may well be reviewed in terms of shop procedure existing in industry. As a suggestion, organization and management of industry, the control of tools and stock, the processes and methods, and finally the analytical interpretation of the job at hand could be followed. It may be that we have been guilty of using the "lazy man's method" in providing job outlines and procedures, rather than developing the ability in the student to work out the solution to the problem. Methods and procedures change so rapidly in industry, that it behooves us to make students alert to possibilities of doing a job in a different way.

Objective No. VII

"To develop the habit of self-discipline which requires one to do a thing when it should be done, whether it is a pleasant task or not."

1. Unfortunately our educational theories have been so interpreted as to discourage the development of this trait. The idea of permitting the spontaneous interest of the child to determine what he shall learn, or what he shall do, destroys the fiber from which men are made. The self-denial and self-discipline which requires one to do a thing, which should be done whether it is pleasant or not, is the very essence of civilization. It should be held up as an ideal.

Now more than any other time in the world's history is the need to recognize this fact imperative. Our very existence depends upon it — the success of the peace following this war depends upon it. It cannot be emphasized too strongly now.

Objective No. VIII

"To develop the habit of careful, thoughtful work without loitering or wasting time." (Industry)

This habit should be one of the aims of every undertaking. The essential conditions contributing to it are:

1. A definite objective, clearly visualized and much desired.

There should be no occasion now to have purposeless work in our shops. If we cannot devise our projects to stimulate the interest of the student, to keep him driving every minute of the day, we have failed in recognizing the possibility of industrial-arts education.

2. A definite step-by-step plan for performing the task.

Industrial-arts instructors would do well to acquaint themselves again with the possibility of production methods used in industry. Where such is not possible or impractical to do in the school shop, then the individualized work must be such that there is no doubt in the student's mind what is expected of him and when.

3. An emphasis on time as an element in doing the job.

Everyone in this war period is working under pressure. "Time is the essence of the contract" for us as a nation, and as individuals. Does it fail of cogency then, that the same requirement should not be put on students? It *is* being put on students in colleges now, and can well be applied in lesser degree to high school and junior high school boys and girls.

Objective No. IX

"To develop an attitude of readiness to assist others when they need help, and to join in group undertakings." (Cooperation)

1. Industrial-arts instructors will do well to contact personnel managers of industrial plants and ascertain for themselves the part that cooperation plays in the employment and retention of employees. The day of the "rugged individualist" is gone, and it is our duty to insist that cooperation with others in the shop, in giving assistance to others, to accepting assistance from others, and cooperating with a group, be one of our major duties. Regardless of the proficiency gained in a trade or skill, if the quality of cooperation is lacking, the chances are he will be out of employment the greatest part of the time.

We have found that this is especially true with women in industry. Much more emphasis must be placed upon teamwork with girls than with boys.

Objective No. X

"To develop a thoughtful attitude in the matter of making things easy and pleasant for others."

1. The *golden rule of labor* is: "So do your work that others may do their work better."

Under present conditions, the observance of this rule is of great importance. Our whole lives are tied up in one gigantic enterprise requiring intense co-ordination and cooperation; therefore, we must be mindful of the needs of others and to make their work a success.

Objective No. XI

"To develop a knowledge and understanding of mechanical drawing, the interpretation of the conventions used in drawings and working diagrams, and the ability to express his ideas by means of a drawing."

1. So intimately is this objective tied up with every mechanical field, that it is practically a *must* in industrial-arts education. Drawing is a universal language dating back to the Stone Age. In our technological civilization the lack of knowledge of drawing interpretation is inexcusable.

2. Much work can be done in simplifying the teaching of this phase of the work, however, and a limited amount of teacher training can accomplish this. Our experiences in the War Production Program have proven that the training time in blueprint reading can be cut by two thirds from the old method of instruction.

Objective No. XII

"To develop elementary skills in the use of the more common tools and machines, and a knowledge of the methods of procedure in tasks frequently encountered by the average man, together with a knowledge of the working qualities and characteristics of some of our most used materials."

1. As has been noted before, the transfer of skills training from one field to another is a matter of a short time. The development of good muscular co-ordination is of primary importance in the handling of the majority of tools. Proof of this is found in the retraining of workers for the war industries where it has been noted that musicians and people in other lines requiring a high degree of manual dexterity, readily acquire the skills required of the machinist, the sheet-metal worker, and the woodworker.

2. This does not apply, however, to the fundamental knowledges required in each trade. These must be thoroughly acquired for each separate trade. Where they are acquired and in what degree must be determined by the needs of industry since our objectives must change as the student approaches the terminus of his vocational training in school.

3. Knowledge of materials must be a matter of keeping up to date on the newest developments. For example, the place that the wooden airplane will take in the aeronautical field should make for a change in the course of study of the woodworking field, at some point in the schooling of the individual in this work. Likewise, the importance of aluminum and its alloys should indicate that a knowledge and an ability to work with this metal be a *must* in the sheet-metal shop. Similarly, the growth of the use of magnesium in castings and forgings for the machine shop, and many other developments in manufacturing have not been touched by the majority of industrial-arts teachers.

Objective No. XIII

"To develop the ability to use the mathematics required in the various trades."

1. Far too little importance has been attached to the possibilities of teaching mathematics in the shops. True, a great deal of lip service has been given to this, but very little has been done. It is inexcusable for a boy to have spent his time in a woodshop without acquiring the ability to figure a bill of lumber, or to do the simple arithmetic required in this field even for the ordinary home workshop builder. Likewise, the boy graduating from the sheet-metal shop should be well versed in geometric layout required, and possibly a working knowledge of the elementary trigonometry concerned in aeronautical sheet metal. The same is true of machine shop, electricity, and all of the other crafts represented in the usual industrial-arts curriculum of the secondary school.

The task of curriculum revision is never a simple matter, and it is hoped that the foregoing method of reinterpreting a set of stated and accepted objectives in industrial arts will encourage instructors to keep their courses of study up to date. It is not necessary to restate the objectives, but merely to reinterpret them in terms of local needs and national trends in industries. If this is done from time to time, we can be assured of a training program flexible enough to meet the constant changes in our industrial world.

Testing and Tests

PREFLIGHT TEST

WALTER G. HJERTSTEDT

Lane Technical School

Chicago, Ill.

Objectives

1. To test the pupil's knowledge of the fundamental principles of aeronautics.
2. To test the pupil's knowledge of aeronautical terms.
3. To discover the correlation existing between industrial arts and the other subjects in the field of aeronautics.
4. To find out how to adjust the content of the industrial-arts program to the air age.
5. To find out how to enrich and vitalize the industrial-arts program by introducing selected material from different fields of aeronautics.
6. To capitalize upon the natural interests of the child and to encourage him to become more air minded and more air conscious.
7. To discover in the child endowments which might well be capitalized, and abilities which should be recognized and cultivated.
8. To compare attainment with ability and capacity to attain so as to guide learning into channels best suited for each individual pupil.
9. To be able to provide better educational and vocational guidance and to intelligently plan suitable training.
10. To understand and guide the child better from an aeronautical standpoint and to test his abilities and interests.

Note: The following information is for the instructor only.

Scoring test: To get the total raw score for the complete test add the individual raw score found at the end of Parts I, II, III, IV, V, VI, VII, VIII, and IX respectively.

Raw score for Part I .....
Part II .....
Part III .....
Part IV .....
Part V .....
Part VI .....
Part VII .....
Part VIII .....
Part IX .....
Total raw score for the complete test .....

General Directions to the Student: The aim of this examination is to give you an opportunity to show what you have learned from your study of preflight. It is not expected that you will be able to answer every question. Read the directions and every statement carefully and be sure you understand what you are to do before you begin.

Name .....Address .....
Telephone No. .....Date .....
School .....Instructor .....
Course .....Room .....
Date of Birth: Year.... Month.... Day....
Birthplace of Parents
Father .....
Mother .....
What is your father's occupation? .....
What vocation do your parents wish you to follow? .....
What vocation do you wish to follow? .....
Do you like the study of aeronautics? .....
Do you like the study of science? .....
Do you like the study of mathematics? .....
Do you like to build model airplanes? .....
Have you ever been to an airport? .....
Have you ever been up in an airplane? .....
Have you done any reading to give you occupational information about aeronautics? .....
How long have you been interested in aeronautics? .....
Are you interested in reading books pertaining to aeronautics? .....
List subjects that

You like best	*You dislike*
.....	.....
.....	.....
.....	.....
.....	.....

Part I

Specific Directions to the Student: Some of the following statements are true and some are false. Read each one carefully. Put a circle around the letter T if the statement is true. Put a circle around the letter F if the statement is false. You will not be penalized for statements incorrectly marked.

Example:

T F 1. Although carrying mail by air was attempted in 1911, it was ten years later, in 1921, before the first night flight of mail was attempted.
T F 2. Latitude and longitude are calculated in degrees and minutes only.
T F 3. Dr. Hugo Eckner built England's first postwar dirigibles.
T F 4. A pursuit plane must be able to whirl and circle and dive and roll in split second maneuvers.
T F 5. Man's ability to fly through air is a sudden development.

* * *

T F 1. Pitatre de Rozier was the first to make the hazardous attempt to ascend in a balloon.
T F 2. By 1943 more people were employed in the manufacture of airplanes and airplane equipment than in any other single industrial activity.
T F 3. In the future space will be measured in miles rather than in time.
T F 4. The latest interceptor, now being tested for the United States government, is the North American XP-51.
T F 5. The length of a minute of arc measured along a great circle of the earth is often used as unit of length in navigation.
T F 6. The magnetic compass came into general use in Europe about A.D. 1500.
T F 7. Load factor in an airplane is the ratio of load imposed on an airplane just before it collapses to the weight of the airplane.
T F 8. Experience has shown that the

structural weight of landing planes varies from about 25 to 50 per cent of the total weight.

T F 9. Balsa wood is much heavier than spruce.

T F 10. The length of the wing at any given point is called the chord.

T F 11. As the angle of incidence of an airplane wing is increased, so the lift will become greater because of the more violent reaction which it will have upon the passing air.

T F 12. The broad Atlantic was spanned nonstop by a heavier-than-air machine for the first time by Charles A. Lindbergh.

T F 13. Tiberius Cavallo, an Italian, proved to the world that hydrogen-filled containers would rise in the air.

T F 14. The airplane was born on the sands of Kitty Hawk that winter day in 1910.

T F 15. An instrument that measures the elevation of an aircraft above a given datum plane is called an aileron.

T F 16. Aircraft is a term applied to heavier-than-air craft only.

T F 17. The unit by which we measure force is the earth's pull on a mass which weighs exactly one pound at sea level.

T F 18. It is generally said that Borelli's contributions to aeronautical science were of a negative character and that he retarded rather than encouraged the study of it.

T F 19. The two poles — the magnetic north pole and the geographic north pole — are the same.

T F 20. Wilkins, who lived in the seventeenth century, did much to convince people that the problem of flight was one capable of solution.

Scoring Part I: Raw score .....
Total number answered correctly .....

Part II

Specific Directions to the Student: Some of the statements which follow are true and some are false. Read each statement carefully. The false statements have been falsified by the insertion of an incorrect word instead of a correct word. Underline the word in each false statement which makes the statement incorrect. Letter neatly the correct word in the blank space immediately following the statement.

Example:

1. The magnetic north pole swings slowly back and forth in an east-west movement, requiring several *years* to make a complete cycle.

1. centuries

2. A model helicopter which flew with some success was invented by Leonardo da Vinci.

2. _____

3. By international agreement the meridian passing through the so-called passage instrument of the observatory at Greenwich, near London, England, has been selected as the *ninety* degree meridian.

3. zero

4. Zeppelin may have acquired his air-mindedness in the United States.

4. _____

5. The rate of change of momentum is proportionate to the force acting on the body and is in the direction of the force.

5. _____

* * *

1. The location of the center of pressure on an airfoil at any given angle of attack is referred to as being at a given percentage of the aileron.

1. _____

2. An airplane with two main supporting surfaces placed one above the other is called a monoplane.

2. _____

3. Where the model of an airplane is a reproduction of its original but whose wing can be moved for proper placing in relation to the model's different center of gravity, the result is called a fuselage model.

3. _____

4. Little progress toward human flight was made until 1792.

4. _____

5. The Lockheed P-38 Interceptor is one of the newest and fastest scout planes of the British army.

5. _____

6. One great circle degree is equal to 60 nautical miles.

6. _____

7. In the design of an airplane the formulation of the specification is the selection of the fuselage.

7. _____

8. An airship filled entirely with air would have no buoyancy.

8. _____

9. The English Channel was crossed by air by M. Louis Bleriot, an intrepid French aeronaut, in the year 1909.

9. _____

Scoring Part II: Raw score .....
Total number answered correctly .....

Part III

Specific Directions to the Student: Answer each of the following questions with a single word. Letter neatly the answer in the blank space to the right of the question.

Example: What is the distance of a place from the Greenwich meridian called which is measured east or west along its parallel (or along the equator) between the local meridian and the Greenwich meridian?

1. longitude

* * *

1. What did Langley and Manly call their machine?

1. _____

2. What is the name given to the hinged or movable portion of an airplane wing, the primary function of which is to impress a rolling motion to the airplane?

2. _____

3. What is the name of the science and art of flying aircraft which is either heavier or lighter than air?

3. _____

4. Who discovered the helicopter principle?

4. _____

5. What is a cockpit called which is completely housed in?

5. _____

6. What is the total distance from the leading edge to the rear edge of the airfoil called?

6. _____

7. Expressed in angular terms, how many degrees does the entire circumference of a sphere have?

7. _____

8. What is the angle of magnetic dip at the magnetic equator?

8. _____

9. What is the factor of safety if an airplane has a designed load factor of twelve and we can impose only a load of six through violent use of the controls?

9. _____

10. In what year was the first actual power-driven flight accomplished?

10. _____

Scoring Part III: Raw score .....
Total number answered correctly .....

Part IV

Specific Directions to the Student: Each of the sentences in the left-hand column defines one of the words in the right-hand column. Make the proper connections by lettering neatly the number preceding the sentence in front of the word in the right-hand column with which it should be associated.

Example:

1. A mechanically driven fixed wing aircraft, heavier than air, which is supported by the dynamic reaction of the air against its wings. (4) (1) (5) (2)

2. The angle between the chord of the wing of an airplane and the air stream through which the wing is passing at the moment. (3)

3. Synonymous with commercial models means an exact miniature flying reproduction of the prototype, with the same wing setting, control placement, etc.

4. A term having general application to aircraft whose support is chiefly due to buoyancy derived from aerostatic forces: such as a balloon, blimp, dirigible, or any lighter-than-air craft.

5. The quality of an aircraft denoting its fitness and safety for operation in the air under normal flying conditions.

4 aerostat
1 airplane
5 airworthiness
2 angle of attack
angle of incidence
fuselage model
3 scale model

* * *

1. Any surface, such as an airplane wing, aileron, or rudder, designed to obtain reaction from the air through which it moves. (___)

2. The art of operating lighter-than-air craft. (___)

3. The open space in which the pilot and passengers are accommodated. (___)

4. The distance of a place in degrees along its local meridian. (___)

5. The property that gives the magnet its direction-finding usefulness. (___)

6. The tendency of an airplane to maintain a level altitude, both horizontally and vertically.

___ aerostatics
___ aerostation
___ aileron
___ airfoil
___ airplane
___ amphibian
___ balloon
___ cabin
___ cantilever
___ chine
___ cockpit
___ fuselage
___ hydroplane
___ latitude
___ longitude
___ orientation
___ stability

7. When applied to those properties of lighter-than-air craft which are due to the buoyancy of the air.
8. An airplane designed to rise from and alight on either land or water.
9. The angular distance of any place on the earth from the Greenwich meridian measured in degrees along the equator or along any parallel.
10. A part of an airplane which is usually a part of the trailing edge of a wing.

Scoring Part IV: Raw score .....
Total number answered correctly .....

Part V

Specific Directions to the Student: Each of the books listed in the left-hand column was written by one of the authors listed in the right-hand column. Make the proper connections by lettering the number preceding the title of the book in front of the author with whom it should be associated.

Example: See Part IV.

* * *

1. *Prize Winners' Book of Model Airplanes*	___	C. L. M. Brown
2. *Building and Flying Model Aircraft*	___	Carl H. Claudy
3. *Dive Bomber*	___	Paul Edward Garber
4. *The ABC of Flight*	___	Hugh J. Knerr
5. *The Student Pilot's Training Primer*	___	W. Lawrence LePage and Edward P Warner
	___	Robert A. Winston

Scoring Part V: Raw score.....
Total number blank spaces correctly filled.....

Part VI

Specific Directions to the Student: The following questions can be answered by a single word. Complete each statement by lettering neatly the missing word in each blank space. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

Example: The ratio of the span to the chord is known as the *aspect* ratio.

* * *

1. Any weight-carrying device designed to be supported by the air, either by buoyancy or by dynamic action is called .....
2. Pursuit ships have one purpose in life —to .....
3. A lever having a rotable wheel mounted at its upper end for operating the longitudinal and lateral control surfaces of an airplane is called a wheel control or control .....
4. When an airplane is being pulled through the air, either by a motor or by gravity, the many forces involved may be visualized as concentrated in two directions, one upward, known as lift, and one to the rear, known as .....
5. A plane which does not pass through the center of a sphere marks a circle, the circumference of which is smaller than that of a ..... circle.
6. The history of air transportation really begins with the aviator .....
7. The angle between the line of true north and the line in which the magnetic needle points is known as the variation or the angle of .....
8. Two types of miniature airplane reproductions are specified, namely, scale models and ..... models.
9. The work of Lana may perhaps be described as the grandfather of the .....
10. The flight that did more than any other to commercialize the use of the airplane was the historic flight by Charles A. Lindbergh in 1927 from New York to .....

Scoring Part VI: Raw score .....
Total number of blank spaces correctly filled..

Part VII

Specific Directions to the Student: The following questions can be answered by a single word. Complete each statement by lettering neatly the missing word in each blank space. The missing words may be found in the list of words in the left-hand column. Do not use the same word more than once. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

Example:

airfoil
fuselage
magnet
reaction

1. For every reaction there is an equal and opposite *reaction.*
2. The unstable wing of an airplane will require a *fuselage.*
3. The principle of the magnetic compass is based upon the property of orientation of a *magnet.*

* * *

aileron
airfoil
attack
Berlin
Borelli
camber
cantilever
da Vinci
equilibrium
forty-five
incidence
internal
London
nautical
ninety
Paris
statute
thirty
Wilkins
Wright
zero

1. As one goes north or south of the equator, the angle of dip increases, until the magnetic pole is reached, where it is ..... degrees.
2. The angle of an airplane wing setting, relative to the line of motion, is called the angle of .....
3. The first man known to have considered the problem of flight from the scientific point of view was .....
4. An air-brake flap is a hinged or pivoted airfoil forming the rear portion of an airfoil, used to vary the effective .....
5. An airplane wing with all the bracing on the inside is called a ..... wing.
6. Specific tests and the development of the lift and drag coefficients have revealed the fact that lift and drag vary directly as the density of the air, the square of the speed, and the area of the .....
7. In round figures the circumference of the earth measures about 25,000 ..... miles.
8. The Great Nassau made a remarkable journey in November, 1836, when Green and two companions took it to .....
9. The first ones to apply successfully motive power to the gliding machines, which they and others had been experimenting with for years were the ..... brothers.
10. Every body continues in a state of rest or uniform motion, unless acted upon by an ..... force.

Scoring Part VII: Raw score .....
Total number of blank spaces correctly filled..

Part VIII

Specific Directions to the Student: Each of the following statements can be correctly completed by the use of one of the words contained within the parentheses. Underline the correct word in each sentence.

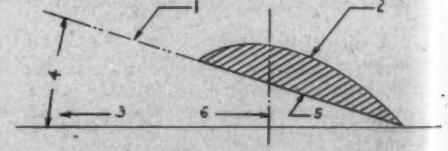
Example: 1. Green proposed a trans-Atlantic air passage about the year (1800, 1840, 1880, 1920).

1. The magnetic compass is believed by some historians to have been known as early as 2700 B.C. in (Egypt, China, Italy, Europe).
2. The part of the trailing edge of a wing which is movable and used to roll or balance the airplane is called (a rudder, a flap, a wing, an aileron).
3. The first stage of progress in aeronautical science was established by (Borelli, Wilkins, Lindbergh, da Vinci).
4. The propeller blades may be considered as (airfoils, ailerons, chines, cowling).
5. A mechanically driven fixed-wing aircraft, heavier than air, which is supported by the dynamic reaction of the air against its wings is called (an airplane, a dirigible, a balloon, a zeppelin).
6. The intersection of the bottom with the side or deck of a seaplane float is called a (flap, rudder, chine, tab).
7. If the load is forward of the center of pressure, the front edge of the airfoil will tip down and the combination will slide down on the (propeller, thrust, air, wing).
8. Any place on the earth's surface describes a full arc every 24 hours of (90, 180, 270, 360) degrees.
9. In aircraft construction the German Zeppelin suggested the possibility of (bamboo, aluminum, steel, wood).
10. The airplane has progressed from an inventor's frail machine to an intricate mechanism of transportation in the short space of less than (one, two, three, four) decades.

Scoring Part VIII: Raw score ..... words underlined correctly.
Total number of questions underlined correctly .....

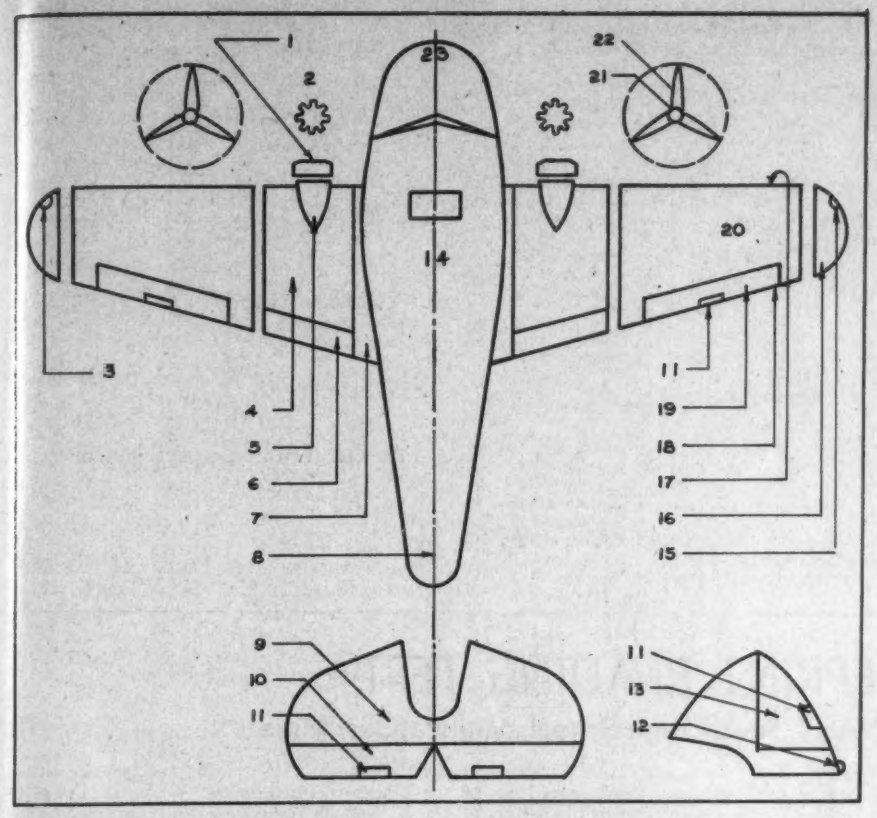
Part IX

Specific Directions to the Student: In the diagram below you will find the nomenclature of an airplane. Each number from 1 to 23 represents a different part of an airplane. In the two columns below you will find the names of these parts. Make the proper connections by lettering neatly in the blank spaces below the number found in the diagram which corresponds to the proper term found in the two columns below.



Example:

6	axis of rotation	5	blade face
4	blade angle	1	chord line
2	blade back	3	direction of rotation



___ aileron
___ center line of
___ thrust
___ center wing
___ section
___ elevators
___ engine
___ engine cowling
___ engine nacelle
___ fillet
___ fuselage
___ green guide light
___ horizontal
___ stabilizer
___ inboard wing
___ section
___ leading edge
___ nose
___ propeller
___ red guide light
___ rudder
___ spinner
___ trailing edge
___ trimming edge
___ white taillight
___ wing flaps (air
___ brake)
___ wing tip

KEY — PART I

True: 1, 2, 4, 5, 7, 11, 13, 17, 18, 20
False: 3, 6, 8, 9, 10, 12, 14, 15, 16, 19

KEY — PART II

True: 3, 4, 6, 8, 9
False: 1. (aileron) should be (chord)
2. (monoplane) should be (biplane)
5. (British) should be (United States)
7. (fuselage) should be (engine)

KEY — PART III

1. airdrome; 2. aileron; 3. aeronautics; 4. Leonardo da Vinci; 5. cabin; 6. chord; 7. 360; 8. zero; 9. two; 10. 1903

KEY — PART IV

1. airfoil; 2. aerostation; 3. cockpit; 4. latitude; 5. orientation; 6. stability; 7. aerostatics; 8. amphibian; 9. longitude; 10. aileron

KEY — PART V

1. Carl H. Claudy; 2. Paul Edward Garber; 3. Robert A. Winston; 4. W. Lawrence LePage and Edward P. Warner; 5. Hugh J. Knerr

KEY — PART VI

1. aircraft; 2. fight; 3. column; 4. drag; 5. great; 6. Nader; 7. declination; 8. fuselage; 9. balloon; 10. Paris

KEY — PART VII

1. ninety; 2. incidence; 3. Leonardo da Vinci; 4. camber; 5. cantilever; 6. airfoil; 7. statute; 8. London; 9. Wright; 10. external

KEY — PART VIII

1. China; 2. an aileron; 3. Borelli; 4. airfoils; 5. an airplane; 6. chine; 7. air; 8. 360; 9. aluminum; 10. four

KEY — PART IX

1. engine cowling; 2. engine; 3. red guide light; 4. inboard wing section; 5. engine nacelle; 6. wing flap (air brake); 7. fillet; 8. center line of thrust; 9. horizontal stabilizer; 10. elevators; 11. trimming edge; 12. white taillight; 13. rudder; 14. fuselage; 15. green guide light; 16. wing tip; 17. leading edge; 18. trailing edge; 19. aileron; 20. center wing section; 21. spinner; 22. propeller; 23. nose

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IV — Example 4, Question 2
Questions 7 and 10
VI — Question 1
VII — Question 4
VIII — Questions 3 and 4

HOUSE PLANNING TEST

WILLIAM CECIL FORD
Assistant Chief Instructor
The Glenn L. Martin Company
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Middle River, Md.

I. List seven types of dwellings used by people of the prehistoric age.

1. ..... 4. .....
2. ..... 5. .....
3. ..... 6. .....
7. .....

II. Give brief characteristics of the following early historic types of structure:

A. Egyptian

1. ..... 3. .....
2. ..... 4. .....
5. .....

B. Greek

1. ..... 3. .....
2. ..... 4. .....
5. .....

C. Roman

1. ..... 3. .....
2. ..... 4. .....
5. .....

III. Give brief characteristics of the following types of homes:
A. Northern Colonial

1. ..... 3. .....
2. ..... 4. .....
5. .....

B. Dutch Colonial

1. ..... 3. .....
2. ..... 4. .....
5. .....

C. Southern Colonial

1. ..... 3. .....
2. ..... 4. .....
5. .....

IV. List twelve types of architecture.

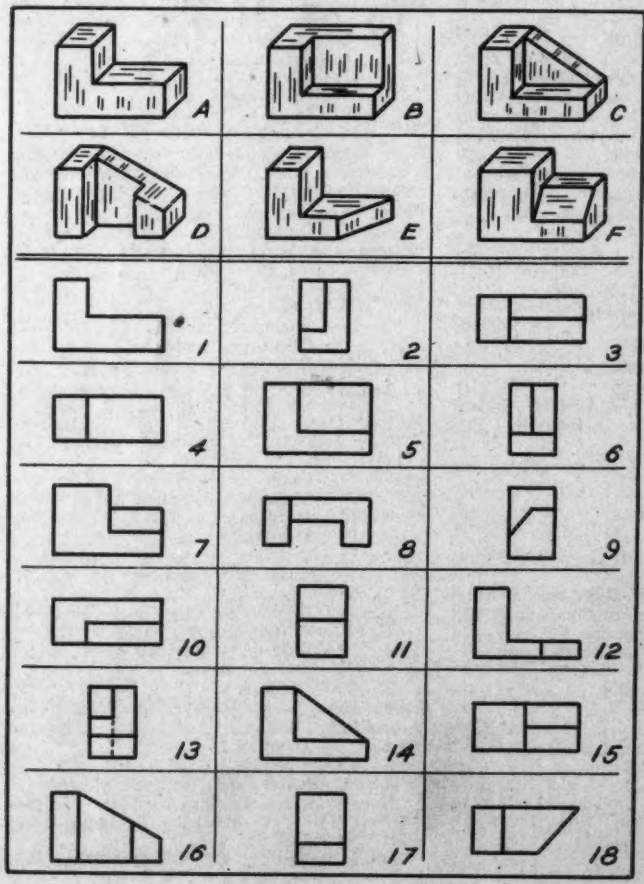
1. ..... 4. .....
2. ..... 5. .....
3. ..... 6. .....

(Continued on next page)

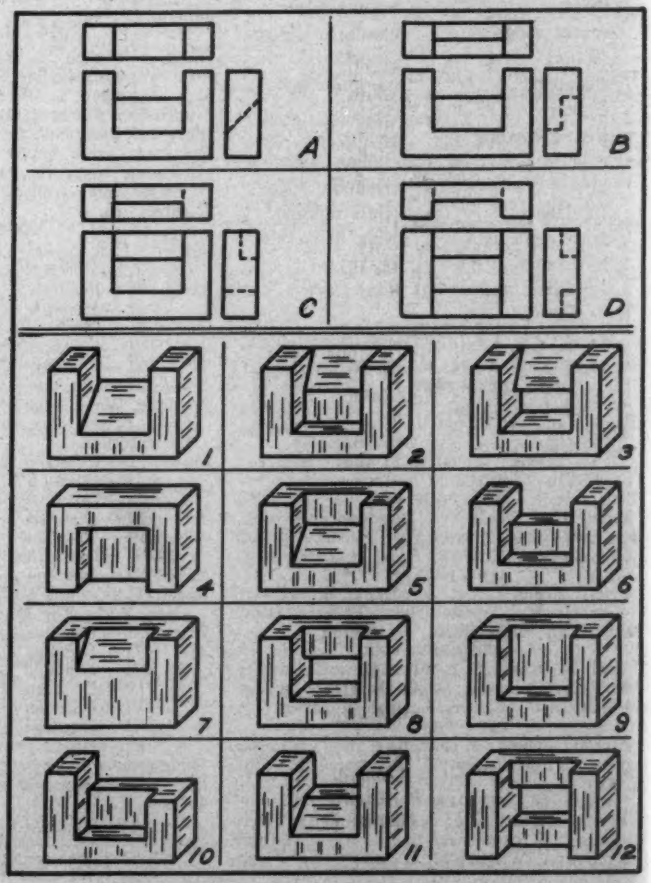
BLUEPRINT READING TEST

W. W. STURTEVANT, South High School, Minneapolis, Minn.

Directions: Write on a slip of paper the letters A, B, C, D, E, and F, indicating the blocks shown below. After each of these letters write the letters F, T, and E, to indicate front, top, and end views. Study the views and place the correct number after each letter. Example: A—, F-I, T-4, E-II. Do not mark on this sheet.



Each of the following four mechanical drawings at the top of the sheet shows one of the blocks pictured below. Write on a slip of paper the letters A, B, C, and D, indicating the four mechanical drawings. After each of these letters write the number of the block of which it is a drawing. Do not mark on this blueprint.



(Continued from previous page)

7. ..... 10. .....

8. ..... 11. .....

9. ..... 12. .....

V. Name five orders of columns.

1. ..... 3. .....

2. ..... 4. .....

5. .....

VI. List ten *checkup* points that you should consider in purchasing or remodeling a home.

1. ..... 6. .....

2. ..... 7. .....

3. ..... 8. .....

4. ..... 9. .....

5. ..... 10. .....

VII. List four things that you should remember when placing bracket lighting fixtures in the home.

1. ..... 3. .....

2. ..... 4. .....

VIII. List four general factors that should be considered when setting up standards for judging a home.

1. ..... 3. .....

2. ..... 4. .....

IX. Define the following terms:

1. architecture
2. order
3. buttress
4. dormer
5. cornice
6. gable
7. gambrel roof
8. elevation
9. perspective
10. lintel
11. stoop
12. pilaster

X. List five important things that should be considered when you select a building site.

1. ..... 3. .....

2. ..... 4. .....

5. .....

Key

I. 1. Cave dwellings
2. Hut of boughs and leaves
3. Hut of stone
4. Tent
5. Sod house
6. Tepee
7. Igloo

II. A. Egyptian
1. Central hall
2. Rectangular shape
3. Flat roof
4. Roof garden
5. Outside stairway

B. Greek
1. Rectangular
2. Porches entirely around house
3. Interior court
4. Roof supported by beams
5. Beautiful columns

C. Roman
1. Central hall and interior court
2. Arch, dome, vault
3. Roof of burnt tile
4. Private pools and showers
5. Charcoal burners for heat

III. A. Northern Colonial
1. Rectangular
2. White-paneled doorway
3. Gambrel roof
4. Built-in chimney
5. Shuttered windows

B. Dutch Colonial
1. Low and broad
2. Porch
3. Gambrel roof
4. Built of stone
5. One story and half

C. Southern Colonial
1. Large porch
2. Deck roof
3. Central hall
4. Ballroom
5. Outside chimney

IV. 1. Egyptian
2. Greek
3. Roman
4. Spanish
5. Gothic
6. Norman-French
7. English
8. Northern Colonial
9. Dutch Colonial
10. Southern Colonial
11. Bungalow
12. Modernistic

V. 1. Doric
2. Ionic
3. Corinthian
4. Tuscan
5. Composite

VI. 1. Foundation
2. Cellar
3. Heat
4. Roof
5. Walls
6. Bathroom
7. Woodwork
8. Closets
9. Electric outlets
10. Garage

VII. 1. Place in relation to wall
2. Keep in repairs
3. If there are two pairs in room, set them on opposite walls
4. Bear in mind furniture which will be located near them

VIII. 1. Special needs
2. Needs of entire family
3. Furnishings
4. Grounds

IX. 1. The science or art of building.
2. A system of constructing columns.
3. Masonry or brickwork built on to an outside wall to afford support.
4. A window set vertically in the side of a roof gable.
5. The highest projection or border on a wall or column.
6. The triangular end of a building.
7. A roof, the upper part which slopes off from the lower at an obtuse angle, making the gable pentagon.
8. A sketch plan of the front or principal side of a building.
9. The art of representing objects on a plane surface as they appear to the eye.
10. The horizontal top piece of a door or window.
11. Outside veranda or porch with seats.
12. A square column or pillar inserted partly in a wall.

X. 1. Outlook
2. Distance to business
3. Accessibility to church, school, etc.
4. Size and contour of lot
5. Relation of lot to desired house

CABINETMAKING TEST

W. H. BOWERS
High School
Tuckahoe, N. Y.

Technical and Related Information

General directions: Read each question carefully, and then proceed to answer the question. If you do not know the answer to a question, do not spend too much time on it, but proceed to the next one. This is not a test to see how fast you can work, but do not waste time. When you have finished one part start on the next. After the examination begins no questions will be answered. Are there any questions now? If not, begin.

Part I

True-False Statements

Directions: Some of the following statements are true, and some are false. In each case make a circle around the capital T if you think the statement is true, or make a circle around the capital F if you think the statement is false.

T F 1. When stock is being squared up the sliding T bevel should be used in testing for squareness.
T F 2. White wood (poplar) is a harder wood than maple.
T F 3. Oily rags and waste should be placed in wood containers.
T F 4. It is good practice to surface very short boards in a jointer.
T F 5. While working at the band saw, circular saw, or jointer, it is safest for pupils to work in groups.
T F 6. The rubber mats placed around the different woodworking machines are placed there for ornamental purposes.
T F 7. Philippine mahogany is an open-grained wood.
T F 8. When a flat surface is being sanded, the sandpaper should be used on a block.
T F 9. Furniture is stained to bring out the beauty of the wood.
T F 10. Walnut is a heavy wood.
T F 11. Specialization in the machine-shop apprenticeship system was not in vogue twenty years ago.
T F 12. The setting of a marking gauge should be checked with your ruler.
T F 13. When boring holes through stock, bore all the way through.
T F 14. Shellac is a more durable finish than varnish.
T F 15. When starting to square up a board, always square up the working edge first.
T F 16. The band saw is more dangerous than the circular saw.
T F 17. Air-drying lumber is a faster and better method than kiln-drying.
T F 18. The knots in cedar wood do not affect the quality of this type lumber of chests, boxes, and closet linings.
T F 19. The butt hinge is used for hanging doors.
T F 20. Philippine mahogany is an easy wood to finish properly.
T F 21. Walnut is generally considered to be the best wood obtainable for cabinetwork.

T F 22. Hand screws are made of iron, bent in the shape of a C.
T F 23. Files are classified according to the shape of their cross section.
T F 24. The circular saw is often used for cutting curved surfaces.
T F 25. The circular saw is the most dangerous machine in the shop.
T F 26. The teeth on a band saw are of the ripsaw type.
T F 27. The cutter head on the jointer has either two, three, or four knives.
T F 28. The purchaser of dressed boards of lumber pays for the shavings removed by the planer in the mill.
T F 29. Boiling and repeated heatings weaken the quality of glue.
T F 30. Wood is lighter than water.
T F 31. Veneers are usually cut from white wood and from white pine.
T F 32. Plywood is manufactured in only one thickness.
T F 33. The grain more than the color of wood is the important consideration in furniture construction.
T F 34. Lumber for building purposes should have different qualities from that used for cabinetwork.
T F 35. When buying furniture for the dining room it would be advisable to include an overstuffed easy chair.
T F 36. A desk chair and lamp are essential in any writing group of furniture.
T F 37. Good furniture is always held together by means of nails.
T F 38. It is advisable to use stick shellac when filling scratches or nicks in furniture.
T F 39. Maple is commonly used in building construction.
T F 40. Yellow birch is used extensively in the shop.
T F 41. Chestnut and oak woods do not require filler.
T F 42. Black walnut warps easily.
T F 43. Philippine mahogany has a more open grain than Honduras mahogany.
T F 44. Black walnut burls are used for high-grade veneers.
T F 45. Plain black walnut is a very soft wood.
T F 46. Bird's-eye maple resembles poplar in regard to beauty of figure.
T F 47. White pine is used extensively for door and window frames.
T F 48. Hemlock is used for rough framing.
T F 49. Yellow pine is used extensively for framing timber and floors.
T F 50. Stains are always transparent and do not obscure the grain of the wood.
T F 51. Water stains and oil stains are bought ready made and ready for use.
T F 52. Wood filler is applied before the object is stained.
T F 53. Shellac is produced by insects who extract the sap from the young twigs of certain species of trees.
T F 54. Shellac dries very slowly and is easy to brush on.
T F 55. Synthetic lacquer is one of the newest products of the finishing industry being only a few years old.
T F 56. Lacquer brushes may be cleaned with turpentine.
T F 57. Varnish may be thinned by adding turpentine.
T F 58. Varnish produces a beautiful finish and is used on the highest grade of cabinetwork.
T F 59. A wax finish is easy to apply and imparts a dull gloss or sheen to woodwork.
T F 60. Primers, paints, and undercoats can be bought ready made.
T F 61. Upholstery is closely related to cabinetmaking.
T F 62. Tow is made from the dried stems of flax plants.
T F 63. Upholstery nails are obtainable in several different colors.
T F 64. The art of upholstering originated in the U. S.
T F 65. Excelsior is often used for tow.

Part II

Directions: Following are a number of incomplete statements. After each statement there are three words or phrases each preceded by a number. You are to choose the right answer and write its number in the parenthesis, as shown in the sample.

Sample: A plum is a

(1) 1 — fruit; 2 — vegetable; 3 — metal.

( ) 1. In laying out a joint in cabinetmaking, it is best to use a: 1 — knife; 2 — pencil; 3 — 5/8.
( ) 2. No. (5) stamped on the shank of an auger bit indicates that the size of the bit is: 1 — 5/16; 2 — 5/32; 3 — 5/8.
( ) 3. The countersink bit is used for the: 1 — setting of the heads of screws flush; 2 — drilling of holes in hardwoods; 3 — setting of nails.
( ) 4. In estimating the number of board feet in a pile of lumber use: 1 — framing square; 2 — a lumberman's board stick; 3 — shrinkage rule.
( ) 5. When using the hammer, hold the handle: 1 — near the head; 2 — in the middle; 3 — at the end.
( ) 6. The machine used for reducing stock to the desired thickness is: 1 — shaper; 2 — jointer; 3 — planer.
( ) 7. While ripping with the ripsaw, hold the stock: 1 — in contact with the fence; 2 — 1/4 in. away from the fence; 3 — loosely against the fence.
( ) 8. In ripping a board on a circular saw, the saw should extend above the stock: 1 — 4 in.; 2 — slightly above; 3 — 2 in.
( ) 9. The length of 10*d*. nails is: 1 — 1/2 in.; 2 — 3 in.; 3 — 3 1/4 in.
( ) 10. The nail that would commonly be set below the surface is a: 1 — common nail; 2 — box nail; 3 — finishing nail.
( ) 11. The finest grade of sandpaper is: 1 — No. 3; 2 — No. 1; 3 — No. 3/0.
( ) 12. Dowels are used in the construction of glue joints for: 1 — appearance; 2 — ease in assembling; 3 — providing the largest given area.
( ) 13. The easiest stain to apply is: 1 — water stain; 2 — spirit stain; 3 — oil stain.
( ) 14. When hanging a door in a house use: 1 — T hinge; 2 — loose pin butt hinge; 3 — strap hinge.
( ) 15. When fastening boards, the nails should all be driven: 1 — in line with the grain; 2 — staggered; 3 — handiest way.
( ) 16. The cost per foot of white pine at $185 per M is: 1 — $1.85; 2 — $.185; 3 — $18.50.
( ) 17. The tool which can be adjusted to bore various size holes is called: 1 — expansive bit; 2 — adjustable bit; 3 — band saw.
( ) 18. The machine tool for cutting out irregular curves is called a: 1 — circular saw; 2 — shaper; 3 — band saw.
( ) 19. The machine used to prepare the edges of stock to be glued together is the: 1 — planer; 2 — jointer; 3 — circular saw.
( ) 20. The annual growth of a tree is indicated by: 1 — medullary rays; 2 — annular rings; 3 — thickness of the bark.
( ) 21. A board foot is 1 in. thick, 12 in. wide, and the length is: 1 — 10 in.; 2 — 12 in.; 3 — 14 in.
( ) 22. Lumber which is surfaced, sized, or planed, is said to be: 1 — dressed; 2 — worked down; 3 — finished.
( ) 23. Nails are sold by the: 1 — quire; 2 — pound; 3 — gross.
( ) 24. Screws are commonly bought by: 1 — gross; 2 — keg; 3 — pound.
( ) 25. The term f.h.b. is used in describing: 1 — nails; 2 — screws; 3 — abrasives.
( ) 26. The size of a dowel is indicated by its: 1 — diameter; 2 — thickness; 3 — length.
( ) 27. Varnish and paint brushes should be cleaned in: 1 — turpentine; 2 — linseed oil; 3 — alcohol.
( ) 28. Shellac brushes should be cleaned in: 1 — water; 2 — turpentine; 3 — alcohol.
( ) 29. Lacquer brushes should be cleaned in: 1 — thinner; 2 — water; 3 — turpentine.
( ) 30. Enamel brushes should be cleaned in: 1 — turpentine; 2 — thinner; 3 — linseed oil.
( ) 31. Paint brushes should be cleaned in: 1 — alcohol; 2 — turpentine; 3 — water.
( ) 32. When gauging a line on a surface with a marking gauge the part that should be in contact with the edge of the stock is the: 1 — block; 2 — spur; 3 — head.
( ) 33. The saw used to cut a board lengthwise is a: 1 — ripsaw; 2 — turning saw; 3 — crosscut saw.
( ) 34. In making a rough hardwood smooth you should plane: 1 — across the grain; 2 — with the grain; 3 — against the grain.
( ) 35. In sanding a surface it is best to sand: 1 — with the grain; 2 — at right angles to the grain; 3 — at any angle to the grain.

To determine your grade deduct the number wrong from 100 per cent. The amount remaining is the grade that you have obtained for this test. Seventy per cent is considered a passing mark.

Key to Test in Cabinetmaking

End of First Term

1. F	10. T	19. T	28. T	37. F
2. F	11. T	20. F	29. T	38. T
3. F	12. T	21. T	30. T	39. F
4. F	13. F	22. F	31. F	40. F
5. F	14. F	23. T	32. F	41. F
6. F	15. F	24. F	33. T	42. F
7. T	16. F	25. T	34. T	43. T
8. T	17. F	26. T	35. F	44. T
9. T	18. T	27. T	36. T	45. F

(Continued on page 80)

Problems and Projects

LATHE CHUCK HOLDING DEVICE

E. F. JONAS

Instructor, Machine Shop

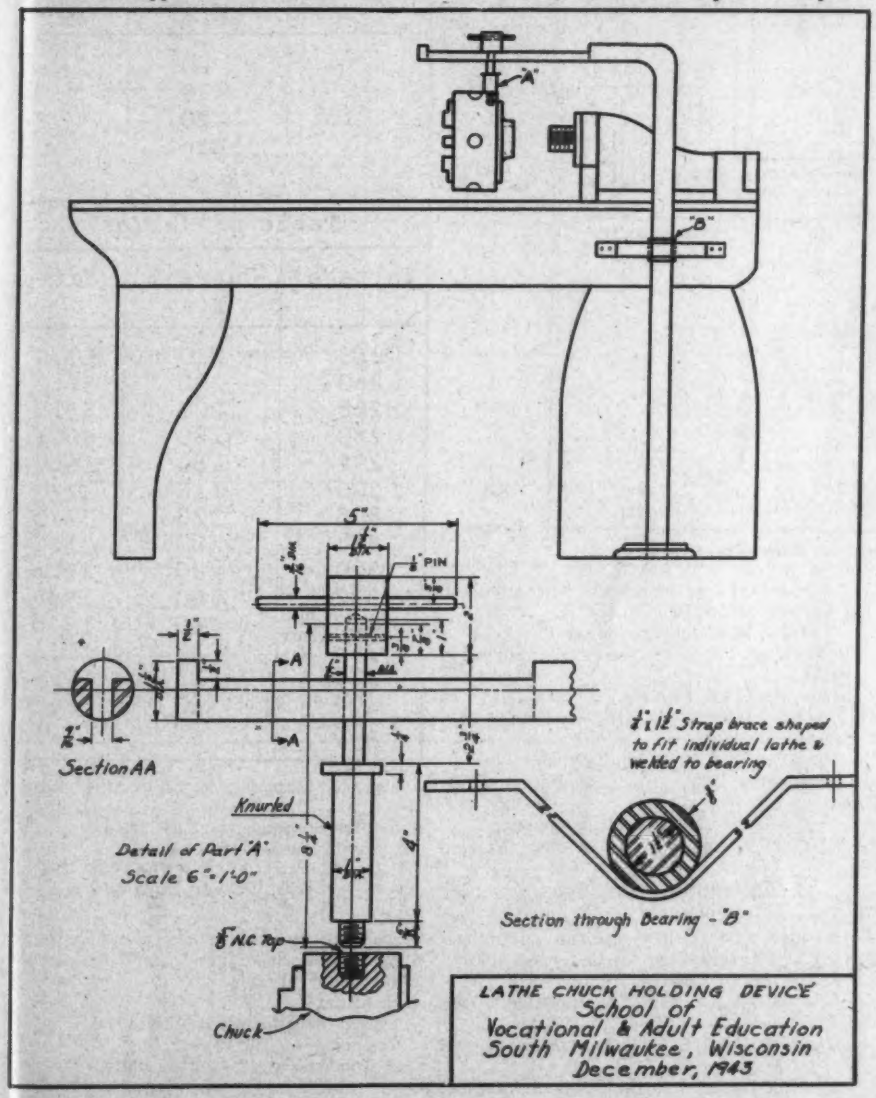
Vocational School

South Milwaukee, Wis.

Injured fingers obtained while mounting or removing a chuck on the lathe can be avoided by using the chuck holding device described herewith. It eliminates the necessity of supporting any of the chuck's weight by the operator. The idea was especially welcomed by our women trainees, and by the smaller students. Further, it does away with the danger of injuring the bed of the lathe when the chuck is accidentally dropped.

When not in use, the chuck may remain suspended on the arm and swung out of the way to the rear of the lathe.

The main support was constructed out of solid rolled stock, the slot being milled out, and the angle bent to suit local conditions. It is made to turn in a metal flange base fastened to the floor, and is braced to the bed of the lathe. It is obvious that the whole arrangement must be made to conform with the shape and size of the lathe on which it is to be used.



A UNIVERSAL POWER SUPPLY

JAMES W. HOSKINS

U. S. Navy Inspector

Palo Alto, Calif.

The universal power supply is designed to fill the need of a unit suitable for supplying power for a variety of radio units, such as small receivers and amplifiers. It is also very useful for testing all types of receivers that have power supply failures.

The unit was built when parts were plentiful and easy to obtain; however, it can be constructed from parts salvaged from old radios. The filter condenser is a paper unit, but a standard electrolytic can be used if a paper unit is not available.

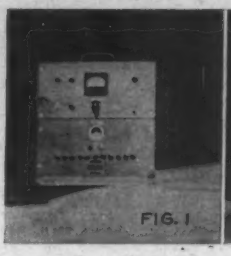


Fig. 1. Power supply, front view
Fig. 2. Rear view

For those who are new to radio the experiment, "A.C. Power Supply," which is inserted near the end of this article, will help explain the theory and operation of a power supply. The construction of the unit is simple enough so anyone can construct it.

The layout of the parts is clearly shown in Figures 1 and 2. The relay rack is constructed of ¾-in. pine and 3/16-in. ply or Prestwood. The uprights are ¾ by 1½ by 12 in.; the top crossbar is ¾ by 1½ by 10½ in. The base is ¾ by 8 by 10½ in., and the panels are 3/16 by 6 by 12 in. The uprights are mounted on the base with 2-in. wood screws and spaced so as to leave about 1½ in. on the front side of the rack. By doing this it prevents the rack from tipping over easily. The rack can be finished in any number of ways. If a good grade of wood is used in the rack, two coats of white shellac and a coat of clear lacquer will give a good finish.

Mount all parts on the various panels, as shown in Figures 1 and 2. Use No. 8-32 bolts for the transformer and chokes. The bleeder resistor is mounted in the bottom of the rack between the panels. The filter condenser is on the back of the rear top panel above the power transformer. Since the rectifier is mounted in a horizontal position, be sure the tube socket is mounted so pins 2 and 4 are in a vertical plane. The wiring is done on each panel and then the rear panels are wired together. Wire the front panel together, leaving the leads long enough to reach the rear panel when the front panels are open. Use a good grade of hookup wire for the high voltage circuits, such as Belden No. 8941 — No. 20 B. and S.; and No. 16 or 18 B. and S. for the remainder of the circuits; No. 16 B. and S. for filament circuits; size 18 B. and S. for primary circuits; size 20 B. and S. for pilot lamp circuits. When wiring switches S_1-S_2-S_3, shown on diagram in Figure 3, be sure to get each circuit on its position of the switch since it is a single deck assembly.

Note: Be sure the adjustable stop is set properly so as not to short out or cross connect any of the circuits on the switch.

Test the entire power supply with an ohmmeter before putting into operation to make sure the circuits are all clear. When

the power supply is first put into operation turn S_1-S_2-S_3 off, thus allowing tube 83 to warm up without voltage on its plates for 15 or 20 minutes to allow the mercury to vaporize in the tube. If a 5Z3 is used, this

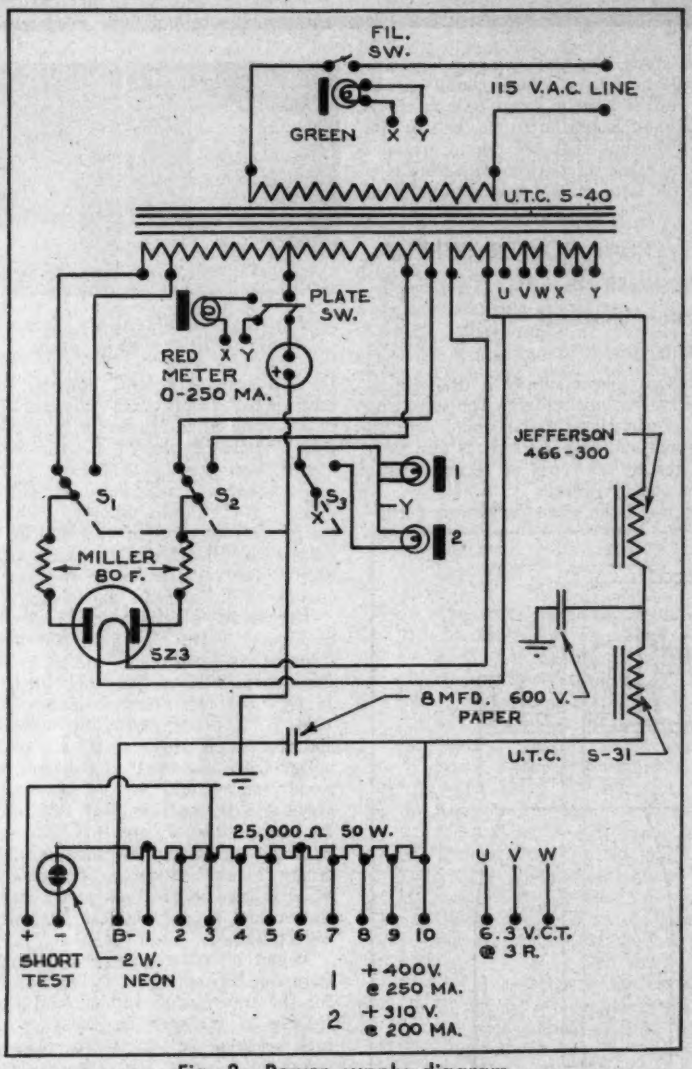


Fig. 3. Power supply diagram

warm-up period is not required since it is a high vacuum tube. The above procedure is only required when a *new* tube 83 is installed, as the mercury adheres to the filament and plates due to the vibration of shipping. When the mercury is once vaporized it will cool or condense on the glass shell of the tube since it is cooler than the plates and filament. Always allow at least a half minute for the tubes to warm up before turning the plate switch on. This protects the tubes and prolongs their life.

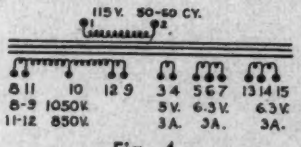


Fig. 4

When 8-9 are connected to the plates of the rectifier, the output will be: 400 V. at 250 M.A.

Jefferson 466—300 Swinging Choke

6 to 3 hy. at 120 to 200 M.A. 75 ohms d.c. resistance

U. T. C. S-31 Filter Choke

15 hy. at 225 M.A. 120 ohms d.c. resistance

Continental E E 8 8 Filter Condenser

2-8 M.F.D. paper condensers with a working voltage of 600 V.

Miller 80-F *Rectifier Hash Filter*

9 M.H. at 200 M.A. 750 V. 9 ohms d.c. resistance

Centralab 2507 *Selector Switch* S-1-2-3

3 poles 2 to 3 positions *Isolantite Insulation*

Ohmite 1209 Voltage Divider

25000 ohms 50 watts tapped every 2500 ohms

Triplett 227-A d.c. Milliammeter

0-250 M.A. Approx. Res. .4 ohm

Operating Instructions

1. Turn on the filament switch, allowing the rectifier tube to heat up and any other 6.3 V. Fil. connected to the power supply.
2. Select the voltage range desired
   Low 310 V. at 200 M.A.; position 2 sw. 1-2-3
   High 400 V. at 250 M.A.; position 1 sw. 1-2-3
3. Connect the load to the terminals marked B—, 1 to 10. The 1 to 10 are the various B plus values obtained from the unit.
4. Turn on the *Plate Switch. Note:* The meter will read 20 M.A. at no load. To determine the output current subtract 20 from the meter reading.

Instructions for Calibration

1. Connect the following parts to the output of the power supply, terminals B— and 10.

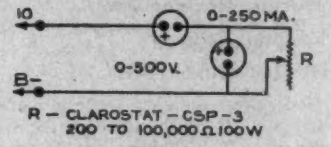


Fig. 5

2. After following the *operating instructions,* start with *R* open and take readings every 10 M.A. Record them in the table shown in Figure 6. See Figure 7. It is a sample table of values.

Table of Values		
Voltage	Current M.A.	Watts
	0	
	10	
	20	
	Etc.	

Fig. 6

Table of Values		
Voltage	Current M.A.	Watts
248	240	59.5
260	220	57.2
268	200	53.6
280	180	50.4
292	160	46.7
300	140	42.0
308	120	37.0
316	100	31.6
320	80	25.6
332	60	19.9
340	40	13.6
356	32	11.4
380	24	9.12
400	20	8.00
408	16	6.53

Fig. 7. Data for an 83-rectifier tube

3. Make a graph from the results obtained in Step 2. See sample graph.

A.C. Power Supply

Object:

To construct and study a simple power supply using choke input and condenser input type of filtering.

Apparatus:

Power Transformer (T-75R50)
2 Chokes (T-19C42)
3 Condensers (2-4 mfd. units, 1-7 mfd. unit)

Rectifier tube *83*
D.C. Voltmeter 0-1000 V.
A.C. Voltmeter 0-1000 V.
A.C. Voltmeter 0-250 V. and 0-10 V.
D.C. Ammeter 0-1A and 0-.1A
3 Resistors (1000 ohms, 250 w.; 2500 ohms, 250 w; 7000 ohms, 250 w)

Method:

Using the "Universal Power Supply" make the alterations shown in Figures 9 and 10, and measure the voltages and current for the three resistors (R_1) as shown on the data and diagram sheets. From the data obtained, plot a graph as shown in Figure 11. Rearrange the filter wiring so the chokes are in the negative lead. Measure the voltages as above, noting the difference. Use an oscilloscope, if available, and check the wave form at rectifier plate, filament, and at each filter condenser. Make a simple diagram of each.

Figure a voltage divider to give the following voltages: 50, 150, and 250. The bleeder is to be installed in a power supply with an output of 500 volts and is to draw 10 milliamperes.

DANGER: This experiment involves 400 volts d.c. and 800 volts a.c. Be careful and stay clear of all high-voltage connections.

Questions:

1. What is the purpose of the filter system?
2. How does the first filter aid in filtering the rectifier output? (Refer to the diagram.)
3. What does inductance do to any change in current flowing through it?
4. What is the purpose of the second or third filter in the diagram?

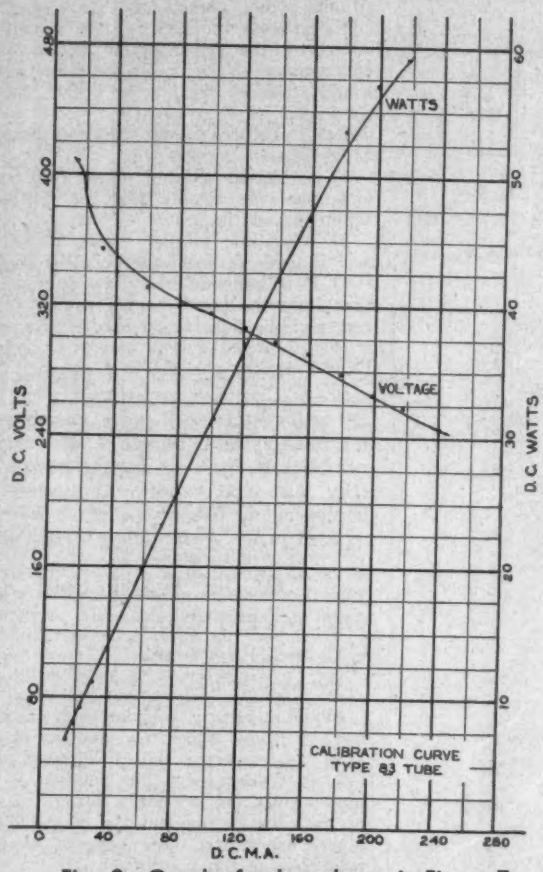


Fig. 8. Graph of values shown in Figure 7

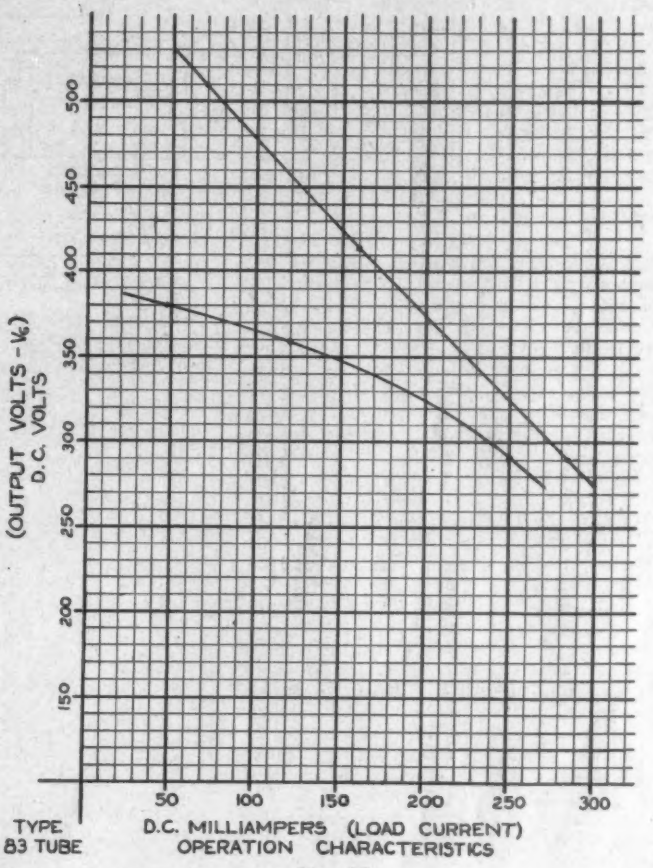


Fig. 11

DATA AND DIAGRAM: A. Choke Input								
R_1	V_1	V_2	V_3	V_7	I	V_4	V_5	V_6
7000r	820V.	410V.	410V.	5.2V.	.048A.	390V.	385V.	380V.
2500r	820V.	410V.	410V.	5.2V.	.12A.	380V.	374V.	360V.
1000r	810V.	405V.	405V.	5.2V.	.25A.	375V.	350V.	290V.

r = ohms

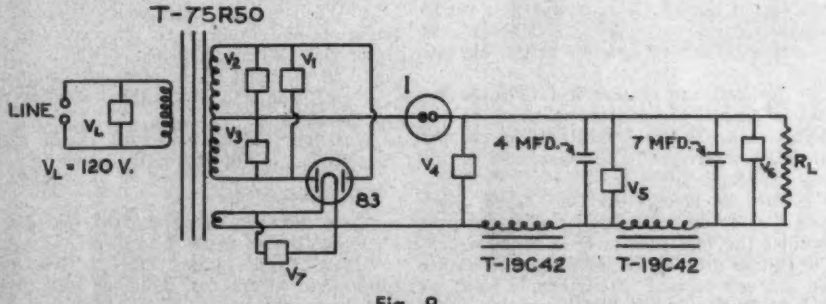


Fig. 9

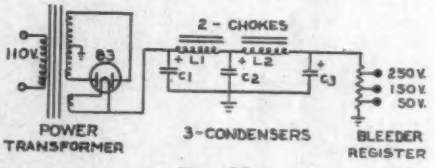


Fig. 12

5. When electrolytic condensers are employed, what care must be taken?
6. Give several advantages of choke input.
7. Give one or more advantages of condenser input.
8. How is the field coil of a speaker usually excited in modern receivers?
9. What must be considered when determining the position of a tap on the voltage divider?
10. Give two or more advantages for drawing a heavy bleeder current. Give two or more disadvantages.

Answers to Questions

1. *The purpose of the filter:* As shown in

DATA AND DIAGRAM: B. Condenser Input								
R_1	V_1	V_2	V_3	V_7	I	V_4	V_5	V_6
7000r	820V.	410V.	410V.	5.2V.	.07A.	520V.	515V.	510V.
2500r	820V.	410V.	410V.	5.2V.	.16A.	490V.	485V.	415V.
1000r	810V.	405V.	405V.	5.2V.	.28A.	400V.	330V.	310V.

r = ohms

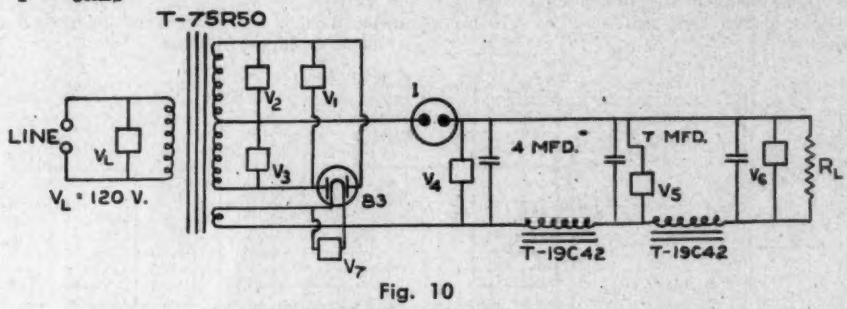


Fig. 10

the oscilloscope patterns, the output of a rectifier which is pulsating d.c. current unsuitable for vacuum tube applications. A filter is used to smooth out the pulsations so that practically unvarying direct current flows through the load circuit. The filter utilizes the energy-storage properties of inductance and capacity by virtue of which energy stored in electromagnetic and electrostatic fields when the voltage and current are rising is restored to the circuit when the voltage and current fall, thus filling in the "gaps" in the rectified output.

2. *The first filter:* Since the power supply as illustrated in Figure 13 utilizes a condenser input type of filtering the first filter does the following. Condenser C1 is supplied directly by the rectifier; in operation C1 is charged to peak voltage available from the rectifier. This charge is withdrawn gradually by the load current. Fluctuation in current is supplied by the rectifier until its voltage is again higher than that remaining on C1.

3. *The effect of induction:* The chokes used in the power supply should have enough self-inductance to provide proper filter in combination with the filter condensers. The inductance opposes the rapid building up of the current as it rises to a peak by building up a counter e.m.f. As the current reaches its peak value and starts to decrease the energy which has been stored in the magnetic field of the choke by the increasing current is now fed back into the circuit. This is shown in the oscilloscope patterns in Figure 13.

4. *The effect of more filtering:* When more filtering is added to the power supply the output voltage is nearer pure d.c. This is found by placing the oscilloscope across the various stages of the filter.

5. *Care of electrolytics:* Electrolytics have a definite polarity that is marked by the manufacturer. If wet electrolytics are used they must be mounted in a vertical position to retain their contents. The electrolytic condenser should never be mounted close to any part of the set that gives off heat; this is due to the fact that it dries up the electrolyte paste used in dry electrolytics or evaporates the liquid used in wet electrolytics.

6. *Advantages of choke input:* Choke input may be used on power supplies where voltage regulation is considered more important than high output voltage. It is also used on power supplies that have high output current and must be protected from

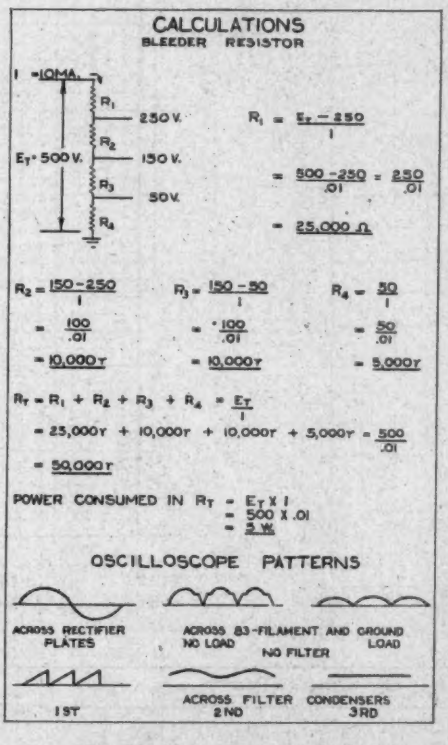


Fig. 13. Bleeder resistor calculations

voltage surges that are caused with a condenser input when first turned on.

7. *Advantages of condenser input:* Condenser input is used in power supplies where high output voltage is necessary with small units. This type of supply is commonly used in receivers since it has a better filtering action.

8. *Connection of speaker field:* The speaker field is generally connected in place of the second choke (L2). In most of the cheaper broadcast receivers the speaker field is the only choke used.

9. *Taps on voltage divider:* When determining a tap on the voltage divider we must consider the fact that there is to be a definite voltage drop across the bleeder resistance for a given current. From Ohm's Law, we find that voltage drop equals current drawn by the circuit times the resistance. Knowing the highest voltage across the bleeder, it is easy to determine various taps on the bleeder by subtracting the desired voltage from the total voltage, and dividing the results by the current desired. This will give the necessary resistance to cause the desired voltage drop. The taps on the bleeder are used to supply voltages to various circuits in the receiver. (Screen grid voltage, detector voltage, etc.)

10. *Two or more reasons for drawing a heavy bleeder current:*

a) It places the load on the power supply as soon as it is turned on.

b) Prevents the high voltage circuit produced by the self-induction action of the high voltage of the power transformer which would otherwise shorten the life of the filter condenser.

Two or more reasons for not drawing a heavy bleeder current:

a) A bleeder current flows continuously and places a definite load on the power supply at all times.

b) When the bleeder draws a high current it tends to lower the output voltage.

c) It is impossible to draw as much current from the power supply since the rated power of the transformer used is of a certain value; thus the output current is equal to bleeder current plus the load current.

I will neither seek nor expect anything for myself; and, though I may perhaps not be able to obtain for the people what they wish and expect, no interest shall induce me to betray the trust they have reposed in me. — *Benjamin Franklin.*

MODEL PLANE UNIT

GEO. W. DEFFENDAHL

Central High School

Evansville, Ind.

Model building is very important as models must be built accurately and to an exact scale. It requires a skilled workman to follow exact dimensions. The building of model planes gives the student a better conception of the construction and use of the different planes which are now being used in the protection of our country.

Job No. 1: To make an elevator of a model plane.

Procedure:

1. Cover the drawing of the type of elevator you have selected with thin paper and carefully trace the outline of the elevator.
2. Cut out template.
3. Trace outline of elevator on a piece of white pine. (Secure material from instructor.)
4. Saw out with jig saw and finish to correct size.
5. When finished, place your initials on the elevator, and bring it to the instructor for inspection. When completed it will be stored until all the parts of the plane are completed.

Note: The stabilizer is the stationary part of the elevator.

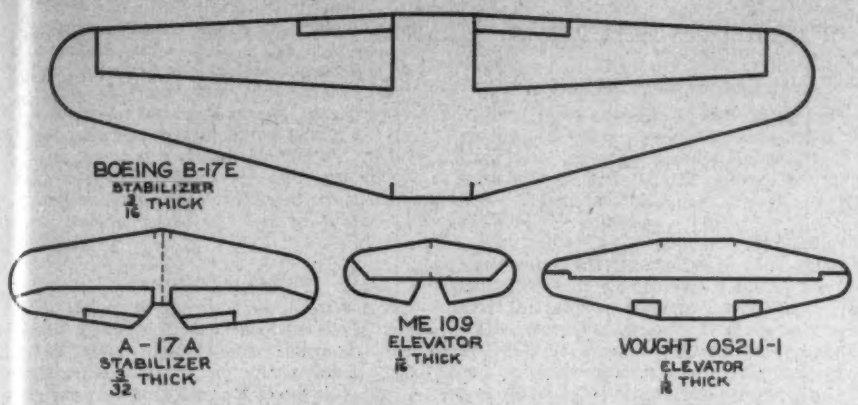
Questions: What is the use of the stabilizer? What is the use of the elevator?

References:

Pope and Otis, *Elements of Aeronautics*

Plane, United States Bureau of Aeronautics

Chart, United States Office of Education, Procedure Chart for Building Scale Model Aircraft.



SIGNAL CORPS DEMONSTRATION BOARD

ROBERT T. STONER

Principal

Pennsylvania State School of Aeronautics

Harrisburg, Pa.

Effective mass training of heterogeneous groups of people in the maintenance of military radio equipment was made possible by demonstration equipment developed under the direction of Mr. Herbert Bair, Senior Instructor in the State School of Aeronautics, Harrisburg, Pa.

The war in which our country is involved is primarily a "war of movement." In this type of conflict effective communications between rapidly moving combat units may mean the difference between the success or failure of a mission. The combat units which move most rapidly are the airplanes. Furthermore, the only means of communication between these units in action is by radio.

The rapid progress made by the Army Air Corps in the use of combat planes was immediately followed by a great surge of new air-borne radio communications equipment. In the Army organization all communication equipment is under the supervision of the Signal Corps. It is the duty of this corps to maintain and repair communication equipment. It is the specific duty of the Signal Section attached to Middletown Air Depot to maintain and repair air-borne radio equipment for Middletown Air Service Command.

At the beginning of the war, the Middletown Air Depot Signal Section was immediately faced with insufficient personnel to do this job properly. The design and operation of air-borne radio equipment differs greatly from the commercial types. The servicing involves the overhaul of transmitters with which most radio service men have had no experience. Furthermore, the Signal Corps specifications of performance far exceed those necessary for a satisfactory operating *home* radio.

Many men servicing radios were not familiar with the test equipment used by the Signal Corps. The supply of good radio servicemen was exhausted almost as soon as it was tapped. New personnel had to be trained in servicing according to Signal Corps specifications. The Signal Corps training section at Pennsylvania State School of Aeronautics was set up to do this training.

Some very astounding facts were discovered at the very beginning of the school. It was found that many radio servicemen, with as much as 15 years' servicing experience, had such improperly conceived ideas of the functions of radio components that they had to start with the rudiments of radio. Many of these new employees were also unfamiliar with certain pieces of test equipment such as the cathode ray oscilloscope, output meter, chanalyst, microvolter, etc. New personnel with no previous radio experience but with high school background also were trained.

The Signal Corps training program was based upon the premise that, if the basic electronic and electrical concepts are understood, radio servicing can be approached by a logical process of eliminating defects until the set functions properly.

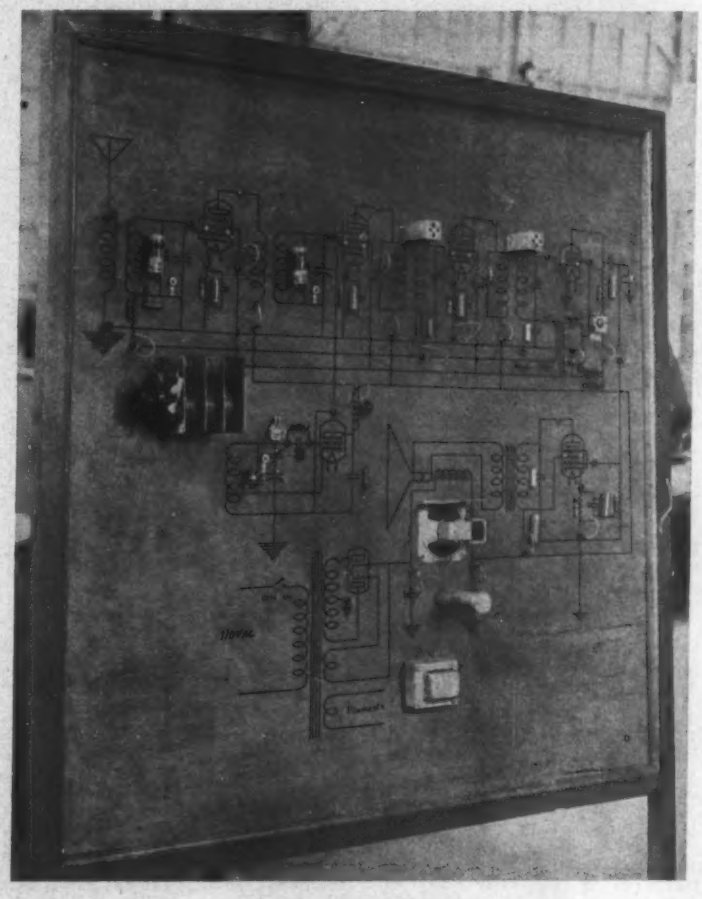
The Signal Section training course was worked out on the conception that all radio receivers and transmitters contained only three basic electronic devices, namely, amplifiers, oscillators, and rectifiers. These basic electronic devices have also only a few major components, namely, resistors, inductors, capacitors, and electronic tubes all working together in circuits containing both alternating and direct currents and voltages.

The trainees were taught basic radio concepts, but encountered difficulty in the application of these concepts to actual servicing work on radio sets. They encountered difficulty also in using test equipment in this type of work. They even encountered difficulty in associating symbols with actual parts of electronic devices and radio sets. All these difficulties were considerably overcome by the use of receiver and transmitter demonstration boards, the designing and construction of which were done by the instructors of the Signal Corps Section of the Pennsylvania State School of Aeronautics.

The following facts furnished the basis for designing the demonstration boards.

Students were familiar with and understand schematic diagrams of radio equipment as a result of their class training, but association of symbols and parts were difficult. Basic uses of electronic devices and how they fit into a complete receiver and transmitter were bewildering. One glance by a student at the underside of a radio chassis produced in the average person mental chaos.

No convenient places seemed available on the component parts of the radio set to attach



Demonstration board

Diagram of demonstration board

test equipment in order to make checks, calibrations, etc.

In keeping with these facts, enlarged schematic diagrams of receivers and transmitters were drawn on plywood, each physical component part was mounted beside its symbol, all parts were wired together in order to make a complete operating unit and, finally, an easy method of connecting the test equipment to the board at selected points was provided.

The Receiver Board

The design of the receiver board was considered first. Air-borne radio receivers were generally superheterodynes. Image frequencies were suppressed; automatic volume control was also a feature. A good basic superheterodyne circuit was worked out having the following electronic devices:

1. Tuned radio frequency amplifier
2. Mixer stage (1st detector)
3. Local high frequency oscillator
4. One intermediate frequency stage
5. Diode second detector
6. Triode audio amplifier
7. Pentode output stage
8. Full wave rectifying power supply

One receiver board was built, and when all *bugs* were worked out, nine copies were made. Much of the wiring of the nine copies was done by trainees.

Numerous pin jacks were placed around the board to facilitate insertion on signals, signal tracing, and testing. The pin jacks were installed in two different ways. They were used as a point of contact or were used with a phone tip as a means of breaking a circuit. Red phone jacks were used for points *hot* for d.c., or signal. Black phone jacks were used for all *cold* points.

In use the boards are simple and convenient to operate. If it is desirable to read d.c. plate voltage on a tube, one meter lead is thrust into a black phone plug which is at ground potential and the other lead into the red phone plug in the plate lead close to the tube. Presence of signal on the plate of that tube may also be found by attaching the oscilloscope leads between plate and ground.

Signal tracing, which is the newer method used in servicing radio equipment, can be effectively taught by the use of the demonstration board. A modulated radio frequency signal may be fed into the receiver between antenna and ground and the signal followed completely through the receiver using either a chanalyst or an oscilloscope as the indicator.

There are other features of the well-designed receiver which are illustrated by the demonstration board and which might also be stressed. Some of these features should be understood to make better radio consumers after the war.

These features are:

1. Tuned radio frequency stage ahead of mixer
2. Separate mixer and local high frequency oscillator
3. Variable trimming and tracking condensers on local high frequency oscillator
4. Good decoupling and isolating networks
5. Diode second detector and automatic volume control
6. Good bypassing of all signals where necessary

If a demonstration receiver of this type is used in a vocational school, it is suggested that the addition of a magic eye tube (such as the 6E5) for visual tuning would be an asset. This additional feature will probably do more to interest than any other addition to the receiver.

The Transmitter Board

Home radio servicemen, even those with as much as 15 years' experience, shudder at the thought of servicing a radio transmitter, because to these men, and to students in general of radio communication, the transmitter is a step into the unknown.

The transmitter demonstration board was developed as a teaching aid to show that the basic electronic elements of a transmitter are much the same as those in a receiver.

The transmitter board was designed around the MOPA (master oscillator power amplifier) arrangement which forms the basis of so many portable transmitters. Provision was also made to transmit either voice, modulated, or C.W. signals.

The transmitter board constructed at the Pennsylvania State School of Aeronautics contains the following basic devices:

1. A shunt fed Hartley master oscillator
2. A grid neutralized triode connected R.F. power amplifier
3. A modulation system composed of (*a*) a class A speech amplifier, (*b*) triode connected push full class A B modulator
4. A full wave rectifying power supply

Pin jacks are also provided in the transmitter circuit for easily connected meter readings.

The transmitter board is particularly adapted for basic tests and operations.

A milliammeter is provided in the plate circuit of the power amplifier to facilitate P.A. tuning. A complete antenna loading circuit is also associated with the R.F. power amplifier for antenna matching work.

The R.F. power amplifier is shunt fed with arrangements for plate modulation. A convenient switch is provided to disconnect the modulator for C.W. transmission.

The interruption of the C.W. for code transmission is accomplished by the use of the telegraph key. The common system of blocked grid keying is used.

Transmitter and receiver boards of this type may be used as a basis for a complete series of operating alignment, and calibration tests. Cases of trouble equivalent of those frequently encountered in practice may be easily introduced into the circuits for student clearing.

Association of the symbols with actual parts and their uses is made much easier for the beginner.

The time of learning can be greatly decreased by use of boards of this type and the interest and imagination of the student are stimulated.

DEMONSTRATION MICROMETER

WALTER J. ROBINSON, Supervisor
and GEORGE H. WELLMAN, Instructor
Machine Shop, War Workers Training Program
Hadley Technical High School
St. Louis, Mo.

Since the inauguration of defense training in 1940, many problems have arisen concerning type of subject matter, skills to be developed, and methods of organizing and presenting subject matter.

Some programs have gone back to the Sloyd system of training. Others have developed jobs which, when finished, will have practical use in the school or shop, while the latest trend is preproduction training in plants and in the schools.

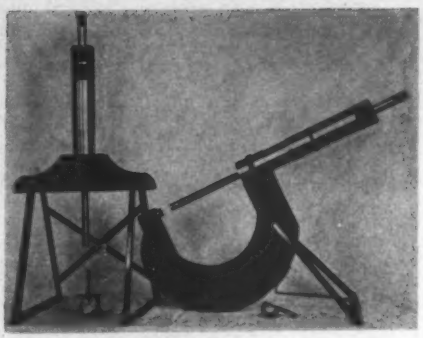


Fig. 2. Demonstration micrometers

A worth-while project developed on the local training program is the construction of a demonstration outside micrometer, and a depth gauge with a micrometer head. There is a great similarity between these two instruments. The only difference is on the base of the depth micrometer, and the figures on the barrel are reversed from those on the outside micrometer. Figure 1 shows the details used in making each of the instruments shown in Figure 2. Each of the finished *Mikes* is made ten times the size of an ordinary 1-in. micrometer.

To Make a Micrometer

1. Obtain stock for bushing of barrel and thimble.
2. Mount chuck on lathe, chuck stock true in lathe, face and bore to required size. Bevel edge of hole to 60-deg. angle to be used for center later.
3. Remove from chuck, mount on a mandrel, and finish turn to size between centers. Allow small shoulder on outside end to keep bushing from being pressed too far into barrel and thimble.
4. Obtain stock for barrel and thimble. Allow 2 in. extra in length.
5. Chuck true in lathe, support end with steady rest, face and bore to required size on small end of barrel. Note: Turn small space on both ends of pipe for steady rest support.
6. Remove work from chuck, press bushing in small end of barrel and thimble. Reverse in chuck and face. Bore other end to size. Bevel edge of hole to 45-deg. angle to be used for center. Bushing will support end of pipe while chucking. Note: Do not face to finished length.
7. Remove work from chuck. Prepare for turning between centers with pipe center in tailstock, using hole in bushing on headstock center. Place dog on work, rough and finish to required size.
8. Remove bushings from end of barrel and thimble and cut off surplus stock.
9. Press unfinished bushings back in end of barrel and thimble.
10. Obtain stock for spindle screw. Mount chuck on lathe. Chuck true, and center drill both ends. Drill and tap one end as shown. Bevel edge of tapped hole to 60-deg. angle to be used for center later.
11. Mount between centers, rough and finish, turn thread as shown.
12. Obtain material for nut.
13. Chuck true, face turn, bore, and thread. Use spindle screw as a gauge.
14. Obtain stock for dummy ratchet.

Diagram of demonstration board

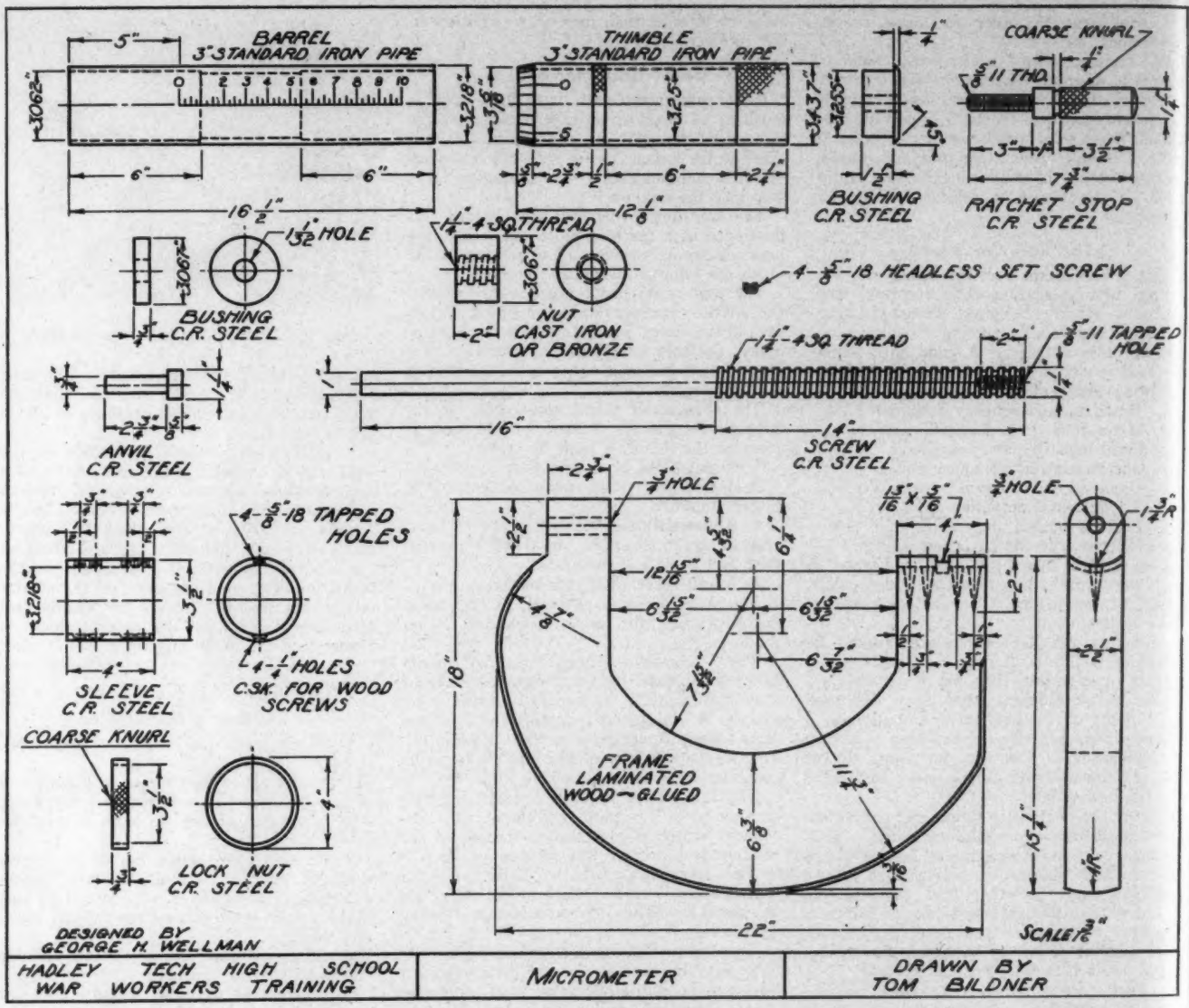


Fig. 1

15. Chuck true, turn thread, and knurl as per drawing. Cut off with cutoff tool, round end.

16. Obtain stock for anvil, mount chuck on lathe, chuck true, turn to size. Cut off with cutoff tool. Reverse in chuck, finish other end.

17. Obtain stock for sleeve. Three-inch standard iron pipe may be used. Chuck, bore, and turn to size.

18. Drill and tap holes as per drawing.

19. Obtain stock for dummy lock nut. Chuck, bore, turn, and knurl to size. Cut off with cutoff tool.

20. Obtain stock for headless setscrews. Chuck, turn, and thread as per drawing. Slot end with hack saw for screw driver.

21. Lay out and make frame. The frame may be made of hard laminated wood.

22. Mark barrel and thimble. Mount dividing head and tailstock on milling machine. With use of chuck mount open end of barrel and thimble on chuck. Clamp sharp pointed lathe tool between spacing collars of arbor. Use graduated dial on table feed for accurate spacing on barrel. Spacing on barrel will be ¼ in. Use dividing head for spacing thimble. Note: Lathe also may be used for graduating barrel and thimble. Graduations should be laid out with dividers for lathe operation.

23. Stamp barrel and thimble. Slip barrel over steel bar held in vice to support walls of barrel and thimble while stamping. Use ¼-in. stamps.

How to Assemble the Micrometer

1. Insert spindle screw in thimble.
2. Screw dummy ratchet in end of spindle, screw through thimble bushing.

MATERIAL FOR OUTSIDE MICROMETER

No. of Pcs.	Name	Material	Size
1	Bushing for barrel	Long round cold rolled steel	3½ x 1 in.
1	Bushing for thimble	Round cold rolled steel	3½ x 2 in.
1	Micrometer barrel	Extra strong standard iron pipe	3 x 18½ in.
1	Micrometer thimble	Extra strong standard iron pipe	3 x 14 in.
1	Spindle screw	Round cold rolled steel	1¼ x 30 in.
1	Nut	Round cast iron or bronze	3¼ x 2 in.
1	Dummy ratchet	Round cold rolled steel	1¼ x 9 in.
1	Anvil	Round cold rolled steel	1¼ x 4½ in.
1	Sleeve	Extra strong standard iron pipe	3 x 6 in.
1	Dummy lock nut	Round cold rolled steel	4 x 1½ in.
1	Headless setscrews	Round cold rolled steel	¾ x 6 in.
1	Frame	Hard laminated wood	2½ x 20 x 24 in.

MATERIAL FOR MICROMETER DEPTH GAUGE

No. of Pcs.	Name	Material	Size
1	Bushing for barrel	Long round cold rolled steel	3½ x 1 in.
1	Bushing for thimble	Round cold rolled steel	3½ x 2 in.
1	Micrometer barrel	Extra strong iron standard pipe	3 x 18½ in.
1	Micrometer thimble	Extra strong iron standard pipe	3 x 14 in.
1	Spindle screw	Round cold rolled steel	1¼ x 30 in.
1	Nut	Round cast iron or bronze	3¼ x 2 in.
1	Dummy ratchet	Round cold rolled steel	1¼ x 9 in.
1	Base	Laminated wood	5 x 5 x 20 in.

3. Press nut in end of barrel.
4. Insert spindle screw through nut in barrel.
5. Nut in barrel may be pressed in position so lines on thimble and barrel meet.
6. Mount sleeve on wooden frame with dummy lock nut in place. Screw wood screw through tapped holes in sleeve.
7. Insert assembled thimble and barrel in sleeve and tighten headless setscrews.
8. Press anvil in wooden frame.

HOMEMADE EQUIPMENT FOR PROCESSING AND STORAGE OF FOOD

LOUIS M. ROEHL

Department of Agricultural Engineering

Cornell University

Ithaca, N. Y.

Potato Storage Crates

Potatoes keep well and store conveniently in slatted crates. If crates are not at hand for storage purposes, a five-bushel crate or bin (Fig. 1) is suggested. The framework consists of two sills 2 by 4 by 24 in., and

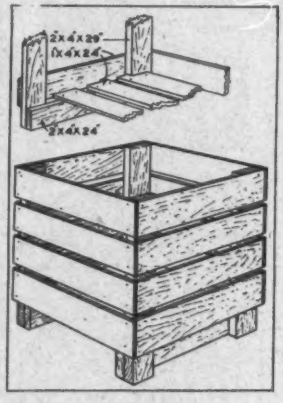


Fig. 1. 5-Bushel crate

four corner posts 2 by 4 by 29 in. Boards 4 in. wide are suggested for sides and bottom, though any boards at hand will do. If floor space is limited, one crate may be placed on another, as is done with bushel crates.

Shelves for Fruit and Vegetable Cellar

The depth, width, and length of shelving for a fruit and vegetable cellar is determined by the need and space available. The plan shown in Figure 2 suggests a width of three roofers which is about 16½ in. A height of 6 ft. places the top shelf within easy reach. A length of 10 ft. is suggested; however, that depends on space at hand. Pieces of 2 by 4-in. material are used for the end posts and 1 by 2 in. for the middle support. Pieces of 1 by 2-in. stock are used for the shelf rests. This plan permits the shelving to be placed without cutting out notches for the posts. This is also a great convenience for placing paper on the shelves. The one by whom the shelving is to be used may desire other spacing of shelves than that suggested in the drawing. A 6-in. shelf is ample for jelly glasses. The bottom shelf is about 22 in. from the floor, thus leaving space beneath for baskets, crates, and boxes.

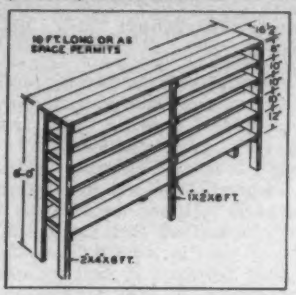


Fig. 2. Storage shelves

Hanging Shelf for Vegetable Cellar

In Figure 3 is shown one method of constructing a hanging shelf. The depth, height, and length is determined by the needs and space available. The length is further determined by the joists above to which the upright members are nailed. One advantage of

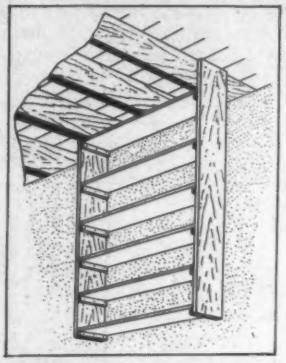


Fig. 3. Hanging shelf

a narrow shelf is that one can readily see what he has. The advantage of a deep shelf as in Figure 2 is that it provides greater shelf space. Shelf spacing is now shown in the drawing. One building a hanging shelf may choose narrow shelves for jelly glasses, 8-in. shelves for fruit jars, and 10-in. shelves for quart jars. It should be noted that the top shelf fits up against the joists.

Ceiling Shelf

Most cellars have need for additional shelving for storage purposes, and it may be had

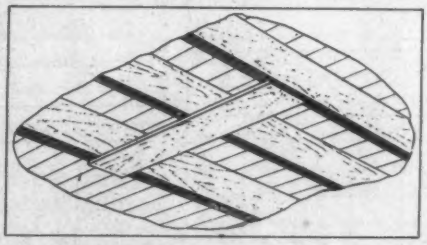


Fig. 4. Ceiling shelf

by nailing a board to the joists as indicated in Figure 4. The length and width of the board is up to the owner. If it is to be used in a vegetable cellar it is suggested that a board that is 2 or 3 in. wide be nailed to the back edge of the shelf to prevent jars from being pushed off. If the shelving is to be used for storing other materials, several narrow boards placed a foot or so apart has been found quite satisfactory. In a workshop it is a good way of storing short and narrow pieces of lumber.

Homemade Tongs for Hot Jars

A convenient canning convenience that can be made easily and quickly is a pair of jar tongs for lifting hot jars out of the canner to the cooling platform. Figure 5 shows its dimensions. It is made of two pieces of hardwood ½ by 1 by 8 in. When making the

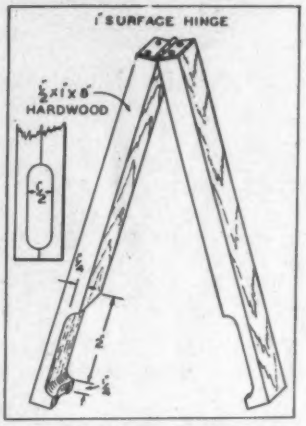


Fig. 5. Tongs for hot jars

tongs, two pieces are held together in a vise as shown in the detail drawing and an oblong hole made with the ½-in. auger bit, chisel, and wood file. The lower end is further shaped with the round or half-round file as shown at the lower end of the drawing. A 1-in. surface hinge is then placed at the upper end as indicated.

Table Rack for Hot Jars

When canning, the operator is in need of a surface on which to set the hot jars. The rack shown in Figure 6 is large enough to hold 12 quart jars. Several racks of this size

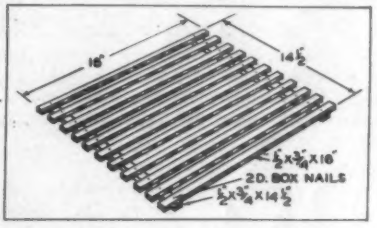


Fig. 6. Table rack

are preferable to one larger one because it is more convenient to store. Slats ½-in. wide may be ripped from a 1-in. board, cut to length, planed, and then nailed to two sills of the same stock with 2d box nails as shown in the drawing. If the nails project through the sills they may be filed flush with the surface or clinched.

Rack for Clothes Boiler Bottom

If the clothes boiler is used for canning work, a false bottom needs to be provided. Plan for such a rack is shown in Figure 7. Its length and width is determined by the size of the boiler. Strips ½ in. wide ripped from a 1-in. board are suitable. Two cross sills of the same material are used. The slats are assembled with 2d box nails.

Rack for Boiler Bottom

If a round boiler is used, the construction shown in Figure 8 is recommended. Length of slats depends on size of boiler. Two nails are used for the slats at the end of the middle sill. Any softwood is suitable for the slats.

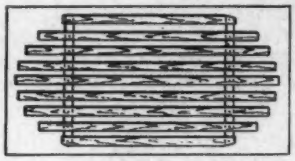


Fig. 7. Rack for clothes boiler

Fig. 8 and Fig. 9. Rack for round boiler and lid for sauerkraut jar

Lid for Sauerkraut Jar

If a large jar is used for sauerkraut, two 1-in. boards may be used. They are held together with two 1 by 4-in. cleats as shown in Figure 9. For a small jar one width of board may do. For it two 1 by 2-in. cleats

Fig. 10. Sauerkraut tamper

are used. The cleats are placed 4 to 6 in. apart so that a stone may be placed on the lid.

Sauerkraut Tamper

A good sauerkraut tamper may be made of a piece of 2 by 4-in. material about 42 in. long. The upper end for a distance of 24 in. is shaped as shown in Figure 10 to make it easy to handle.

THREE PRACTICAL RECORDS

HAROLD M. GRAY

Sumner High School
St. Louis, Mo.

The enrichment of industrial arts by the introduction of new courses, materials, tools, and equipment, projects, and problems warrants one's careful consideration.

In such a broad and extensive field there is a need for practical records in the accounting for equipment, tools and supplies, and finance. It is also understood that equipment, tools, and supplies used in industrial-arts shops are costly items and must be kept up and maintained carefully, if they are to efficiently perform the duties for which they were manufactured and purchased. This also entails expenditure of public monies, and hence requires careful supervision. From an administrative and supervisory standpoint this maintenance also is of utmost importance.

Three essential records which need to be kept by efficient shop instructors are the *Financial Record*, the *Lumber Record*, and a *Continuous Inventory* of tools and equipment. While the records shown here are more applicable to woodworking, they may be used with very few changes for other courses in the field of industrial arts.

The *Financial Record* shown in Form No. 1 presents an easy, yet efficient way to keep an account of money brought in (whether paid to the instructor or to the office), and money spent for projects made. The instructor may keep the records in alphabetical order, or according to the hour the boy comes to class.

At the top of this record there is a space for the boy's name. This should be written with the last name first so as to make alphabetical filing easy. The school that the boy regularly attends is placed in the space provided for it. In cities where there are centers, and boys come from various schools to that center for industrials arts, it may be necessary to have the name of the school. The *class* refers to whether it is woodworking, metalwork, etc. There also is a space provided for the grade the boy is in, and the shop instructor's name. It is important at times to know the days on which the boys take the course, the hour, and the number of the room.

Three columns are provided for necessary information. Credit refers to the amount of money the boy has paid, and debit refers to the amount of money the boy has spent. A space is provided for comments when necessary.

If on September 20, 1940, the boy pays a fee of $1, this information is placed in the

(Continued on page 78)

Continuous Inventory

Course Woodworking School Sumner Instructor W. M. Gray

Name	On Hand May 1940	Rec'd. during Summer 1940	On Hand September 1940	Rec'd. during Year 1940 - 1941	Total Number	Equipment Missing	On Hand May 1941	Rec'd. during Summer 1941	On Hand September 1941	Rec'd. during Year 1941 - 1942	Total Number	Equipment Missing	On Hand May 1942
Hammers - claw 12 oz.	12	2	14	0	14	1/L	13	0	13	1	14	0	14
Planes - jack	36	0	36	0	36	0	36	0	36	0	36	3/R	33
Saws - cross cut	24	4	28	0	28	0	28	0	28	0	28	1/L	27
Saws - crosscut 22 in.	12	0	12	0	12	1/L	11	1	12	0	12	0	12
Screw Drivers 4 in.	6	2	8	0	8	1/R	7	0	7	3	10	0	10

Form No. 3. The continuous inventory

Lumber Record

Course Woodworking School Sumner Instructor W. M. Gray

Bass 1 in. Board Ft.		Cedar 4 in. Board Ft.		Gum 4 in. Board Ft.		Gum 4 in. Board Ft.		W.Pine 4 in. Board Ft.		W.Pine 4 in. Board Ft.	
In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
*240	9	*50	20	*300	10	*150	7	*100	12	*250	6
191	5	30	11	290		143	5	88	6	244	3
186	12	19	20			138		82	20	241	11
174		*100						62	10	230	
		99						52			
								*200	15		
								237			

*Indicates purchase

Form No. 2. The lumber record

Financial Record

Name Williams, Henry L. School Sumner

Class Woodwork Grade 9th Instructor W. M. Gray

Days Mon - Wed - Fri Hour 2nd Room 24

Credit Date	Credit Amount	Date	Amount	Comment
		12-3-40		
9-20-40	$1.00	Table	$.62	
12-3-40	1.38	3-12-41		
1-10-41	52.00	Chair		
3-12-41	$.25			

Form No. 1. The financial record

PLATE 17 — ANIMALS

STUDY THE STRUCTURE AND CONTOUR OF THESE ANIMALS. THEN ADAPT THE KNOWLEDGE TO CREATE NEW DESIGNS

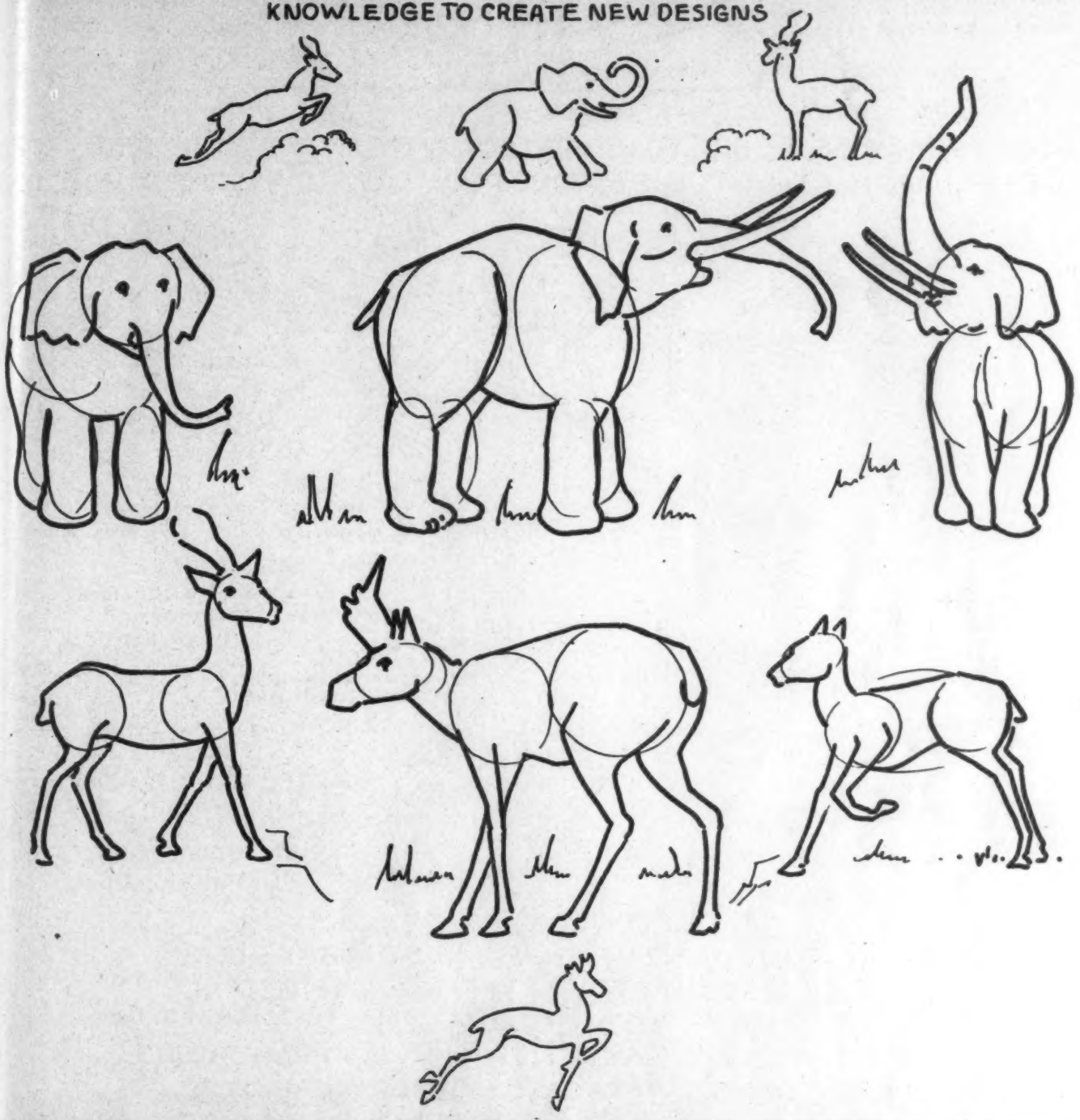
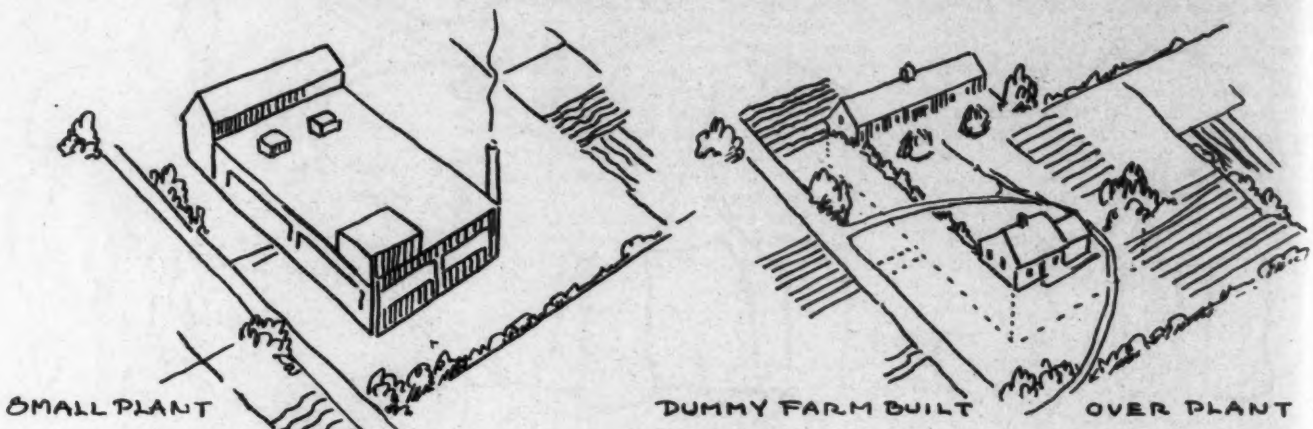
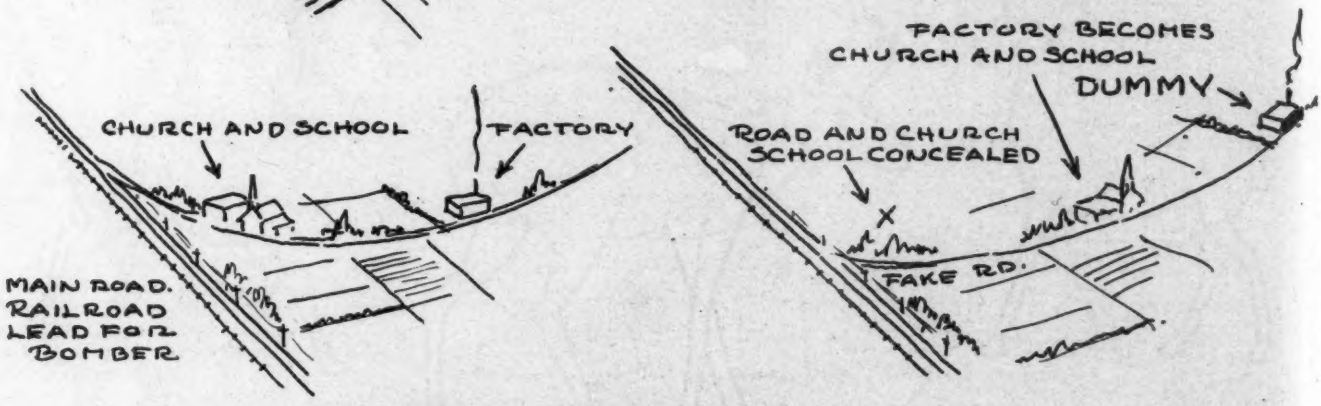


Plate 17. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

Camouflage Mimicry

DECOYS MAY BE BUILT TO IMITATE ANYTHING FROM A TREE TO A CITY— IMAGINATION IS THE STRONG POINT IN THE FIELD OF MIMICRY





• DECOYS ARE USEFUL •
TO CONFUSE THE ENEMY BOMBARDIER
TO CAUSE HIM TO WASTE HIS BOMBS AND
TO SPOIL HIS AIM
TO ATTRACT ATTENTION AWAY FROM TARGET
TO DIVIDE ATTACK BY OFFERING MORE
TARGETS
TO DECEIVE AS TO AMOUNT OF PRODUCTION AND ACTIVITY IN AREA

Plate 11. Camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

CLAY DECORATION (Continued)

Breakfast Ware, The Dedham Pottery
(from "Contemporary New England Handicrafts")

Glaze makes up one of the most effective decorative devices, besides serving as a waterproofing material. Special effects are used, such as crackle glazes, viscous forms that flow irregularly over the ware, crystalline effects, enamels, salt glaze, luster, and many others.

Rookwood Incised Tile
(from Dougherty)

Raised decoration may be formed above the surface of ware, as shown here, or as used by Wedgwood in his famous jasper ware. Incised forms may have either the background or the pattern cut slightly below the surface. A second color clay may be inlaid in the incised area. The related intaglio method removes a narrow line to outline the pattern.

Chinese Peachbloom Chrysanthemum Bottle

Decoration may be formed by piercing the clay in some arrangement. These areas may be filled with glaze. Household wares are frequently decorated by the use of transfer sheets printed from copper engravings and other printing methods.

Plate 31. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

(Continued from page 74)

Credit column under the date and the amount. He completes a table on December 3, 1940, which costs 62 cents, so this information is placed in the *Debit* column. By subtraction it is seen that the boy has 38 cents left, so this amount and the date is placed in the *Credit* column. The boy then wishes to make a chair. It is found that the cost will be over $2, so the boy brings $2 and this is entered on the date he brings it in the credit column. He now has $2.38 to his credit. He makes the chair and again, the date he finishes it and the cost of the chair is entered in the debit column. Subtracting the cost of $2.13 from his credit — $2.38 — shows that there is a balance of 25 cents which is entered in the credit column and can be applied by the boy on his next project.

If an effort is made to keep the record free of mistakes as the year goes by, there will be no difficulties encountered at the close of school in regard to the amounts paid, expenditures, and refunds.

With so many hundreds of board feet of lumber to keep account of, it is necessary to have a simple, efficient method of knowing the amount of lumber used and the amount left in the storeroom, from day to day. Form No. 2 may be used for other materials by placing the name of the material in the same place as the kind of lumber. For example, in metalwork, instead of *Brass* write *Copper*, instead of *Gum* write *Tin*, etc. This record is applicable to many courses where materials are used.

At the top of this record there is a space provided for the name of the course, the school, and the shop instructor. The kinds of wood are arranged in alphabetical order so that each kind and size may be easily found. Assume that some cedar lumber is used, and see how easy it is to keep a record of the amounts used. Fifty board feet had been purchased. This amount has been entered and the item was marked with an asterisk. If 20 board feet are used, that amount is entered in the *Out* column, and the remaining 30 board feet in the lumber room, are indicated as shown. If 11 more are used there are 19 board feet left. When more lumber is bought, it is entered in the *In* column.

Another very important record is the continuous inventory of tools and equipment, shown as Form No. 3. Such a record should be kept from year to year showing the additions and loss of new tools and items of equipment. It is suggested that three copies be kept up to date, so that the supervisor, the principal, and the instructor may each have one.

Tools and equipment should be kept in alphabetical order so that it is easy to find a specific item if necessary. The symbols — W.O., worn out, B, broken, and L, lost — should be used to indicate what may have happened to the tool or piece of equipment in question. Take the item of hammers. On May 1940, there were 12 12-oz. hammers. Two were received during the summer of 1940, making 14 hammers on hand in September, 1940. During the year there were none received, so the total remained 14. However one hammer was missing, so it is indicated with an L, showing that it was lost. In May, 1941, there were then 13 hammers, none were received during the summer, so there were 13 on hand in September, 1941. During the year one hammer was received making the total 14. At the close of school in May, 1942, no hammers were missing, so the total was 14 on hand.

With such an inventory, it is an easy matter to account for all tools and equipment at a moment's notice. If all inventories could be kept in book form, it is easy to find the desired information for any year or years.

The three practical records shown here have been used for a number of years and have been found to be most satisfactory. They are applicable to any course in the field of industrial arts.

SIMPLE ELECTRIC MOTOR

CARL v. LINDEMAN

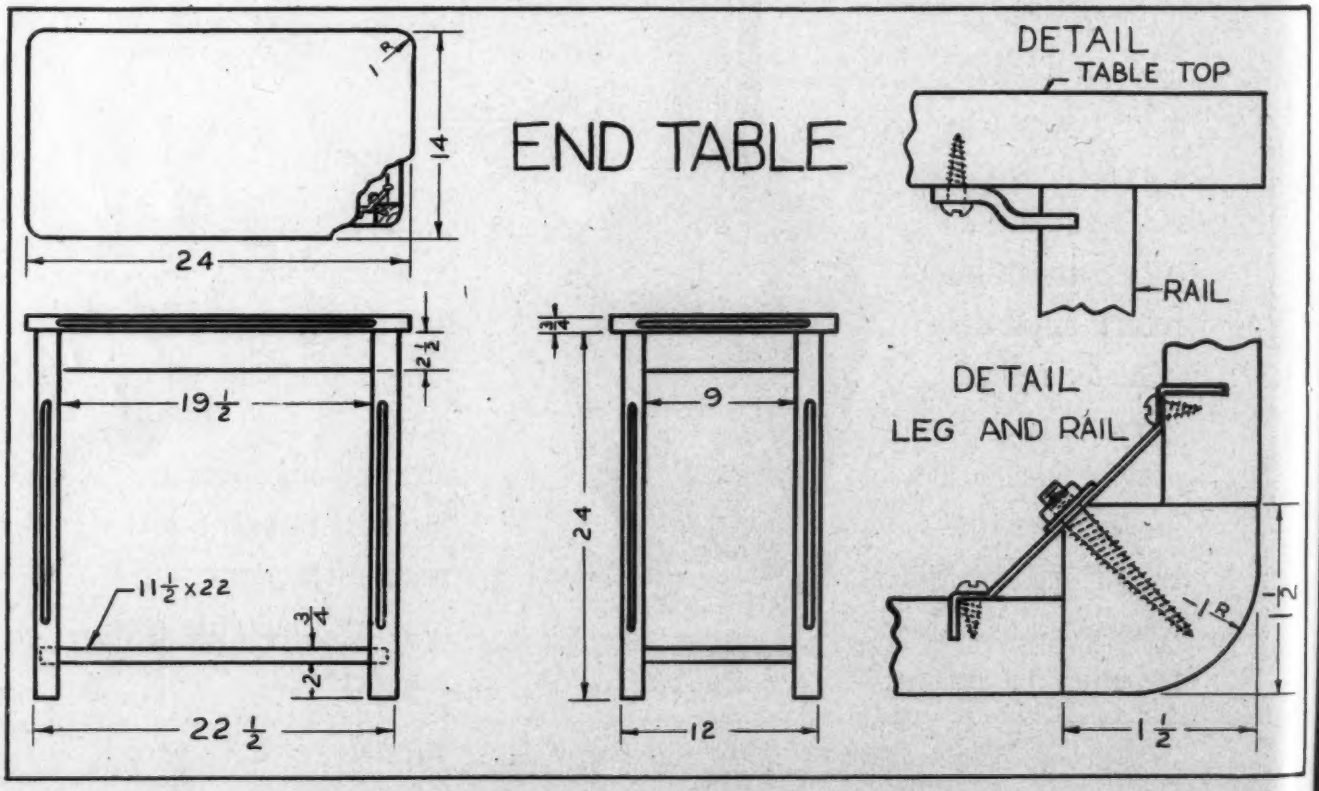
Western State Teachers College

Paw Paw, Mich.

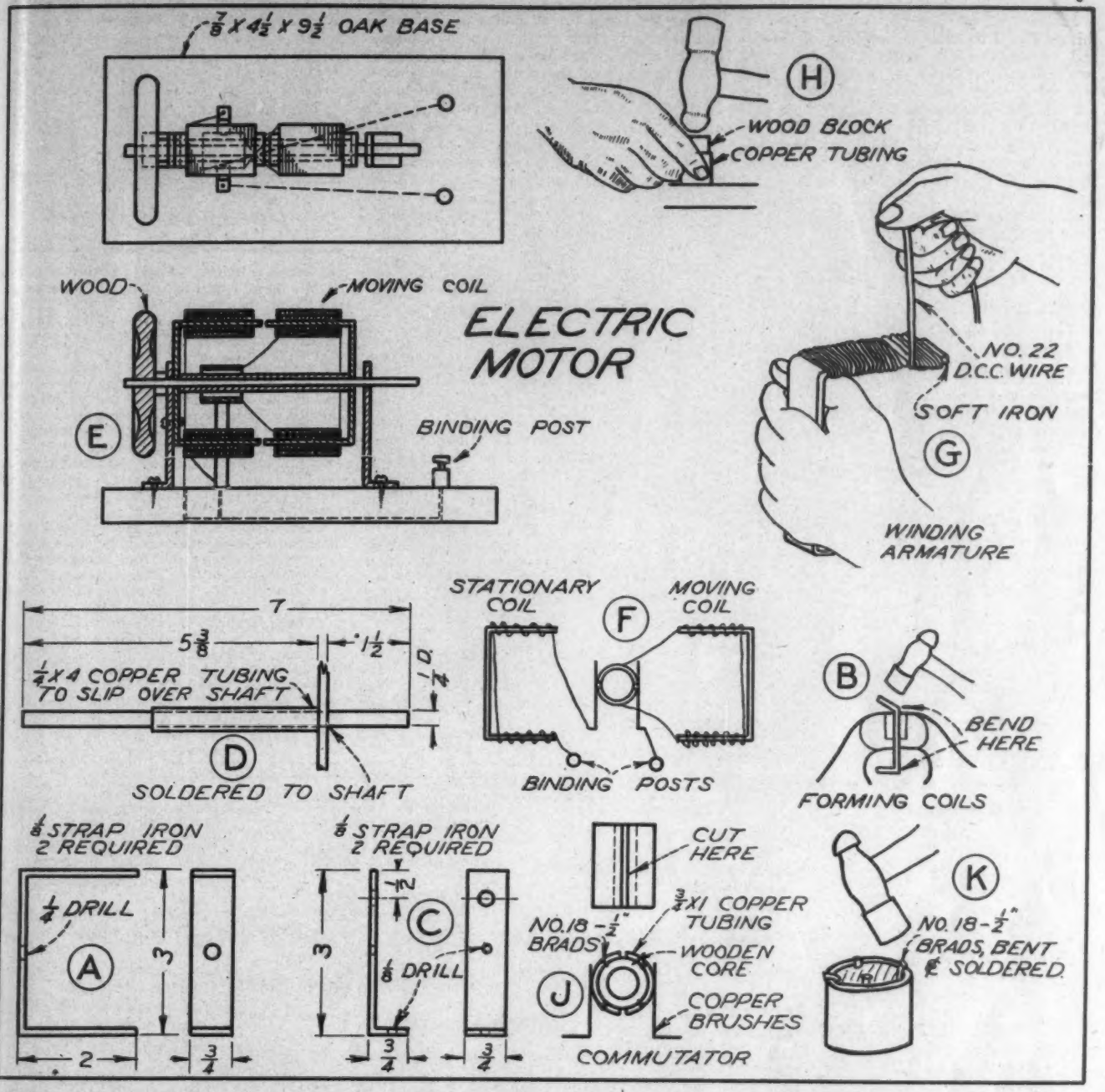
Boys of junior high school age like to make objects which actually run, and nothing keeps their interest and is of greater aid in teaching the fundamentals of electricity than the building of an electric motor. The motor must be simple in construction and still embody the basic principle of motor construction. The motor here illustrated is designed and constructed to operate on one dry cell, and may be run as a series or shunt motor. When two dry cells are applied it has enough power to run toys or small machines.

Motor construction: The base consists of a piece of ⅞ by 4½ by 9½-in. oak, through which holes are bored for binding posts. It is sanded and given a coat of linseed oil and shellac.

Construction of field: The moving and stationary field coils are made of ⅛ by ¾ by 7¼-in. strap iron, bent as shown at *A* and *B* in the illustration. The holes should be bored after bending. Note that two of these pieces are required.



Designed by Louis Barocci, Cudahy High School, Cudahy, Wis.



Field and shaft supports: The field and shaft supports are made of ⅛ by ¾ by 3¾-in. strap iron, bent to the shape and dimension shown at *C* in the illustration. Two of these also are required. The holes are drilled after the pieces are bent to shape.

Shaft: The shaft is made of a piece of ¼-in. round iron. Care should be taken that the shaft is a tight fit in the hole of the field coil frame. One field coil is placed on the shaft and soldered as shown at *D*. It may be necessary to preheat the iron in order to get the solder to stick. If acid is used in soldering, care should be taken that it is cleaned off well, or else the acid will destroy the insulation on the wire. The other field coil may next be bolted with small bolts to the support as shown at *E*. After this has been done the framework may be assembled to shaft supports in order to locate clearance between the two field coils which should not be greater than ⅛ in.

Winding field coils: The field coils are wound with three layers of No. 22 d.c.c. wire. Care should be taken to cross wire when one coil has been completely wound and the other side of coils is to be wound. This is shown in Figures *F* and *G*. The motor will fail to run unless care is taken to get the wire on as shown. Enough wire should be left at the beginning and finish for the necessary connections. A coat of white shellac may be given the windings.

Commutator construction: The commutator is the most difficult part of the construction. It consists of a small piece of copper tubing ¾ in. in diameter, and about 1 in. long. A wood plug is inserted as shown at *H*. Small wire brads are driven into the front and back, and the heads are bent down and soldered to the rim of the tube as shown at *K*. It is necessary to do this as the tube must be cut in two sections as shown at *J*. The purpose of the wood plug, or core, is to hold the two separated segments together and act as a core for the shaft to go through. The ends of the moving field are soldered to the opposite ends of these two segments as shown in the wiring diagram at *F*.

Brushes: The brushes are made from thin copper, or from main-bearing shims. The brushes must be in opposite sides of the commutator as shown at *F* and *J*. Care should be taken to see that the brushes make contact with the commutator.

Wiring of motor: The wiring diagram at *F* shows how the connections are to be made.

Caution: If motor fails to run, the trouble may be located in the brushes or in the winding connections.

Teaching value: The outstanding value in this project is its extreme simplicity of design and construction. It involves most of the fundamental principles of electricity. This type of electric motor may be connected to run as a series or shunt motor; thus, the characteristics of each may be noted. The instructor also may use this project to teach the following: magnetic lines of forces, direction of magnetic lines of forces in a field coil, use of a compass, reaction of magnetic lines of forces causing rotation, and tests for open and short circuits.

TO TRISECT AN ANGLE

JAMES F. FREEMAN

Technical High School
Erie, Pa.

The method of trisecting an angle, shown herewith, may be helpful to students of drafting and mathematics. The writer does not claim originality for this method of trisecting an acute angle, but believes that it may be well to include this method with others that have been developed.

Many drafting students at Erie Technical High School have been interested in finding a method of trisecting an angle. The mathematics class provided the proof of the method illustrated. The drawing and construction are the work of drafting and related mathematics students.

Given the acute angle *GAE*, Figure 1.
Required to trisect angle *GAE*.

Construction

With *A*, in Figure 1, as a center and any convenient radius, draw a circle cutting *AE* at *D*, and *GA* at *K*. Extend line *GKA* through *R* indefinitely. Draw a straight line *BCF*, making *BC* equal to the radius of the circle and passing through point *D* on the circumference of the circle. Angle *KBF* is 1/3 angle *GAE*. With *B* as the center and any convenient radius, draw an arc cutting *BE* at *X* and *BK* at *Z*. With *A* as the center and *BZ* as the radius, draw an arc cutting *AE* at *M* and *AG* at *Y*. Using *XZ* as the radius and point *Y* as the center, draw an arc cutting arc *MY* at *S*. Using *S* as the center and *XZ* as the radius, draw an arc cutting arc *MY* at *T*. From *A* draw a line through *S* and *T* trisecting angle *GAE*.

Proof

Construction for Trisecting an Obtuse Angle

Given the obtuse angle *BAT*, Figure 2.
Required to trisect angle *BAT*.

Construction

With *A*, Figure 2, as a center and any convenient radius, draw a circle. Then draw a line perpendicular to line *AB* at *A* forming a right angle. With the radius of the circle and *B* as the center, draw arc cutting the circumference of the circle at *C* dividing the right angle into two angles, one 60 deg., the other 30 deg.

Then trisect the acute angle *FAT* as in the preceding construction.

Angle *CAD* is 1/3 angle *BAT*.

The proof is similar to the preceding problem.

Statement	Reasons
1. $\angle GAE = \angle GBD + \angle ADB$	1. An exterior angle of any triangle is equal to the sum of the opposite interior angles of that triangle.
2. $AC = AD$	2. Radii of the same circle are equal.
3. $\angle ADB = \angle ACD$	3. Angles opposite equal sides in a triangle are equal.
4. Therefore $\angle GAE = \angle GBD + \angle ACD$	4. Equals may be substituted for equals in any process.
5. $\angle ACD = \angle ABD + \angle BAC$	5. An exterior angle of any triangle is equal to the sum of the opposite interior angles of that triangle.
6. Therefore $\angle GAE = \angle GBD + \angle ABC + \angle BAC$	6. Equals may be substituted for equals in any process.
7. $BC = CA$	7. By construction.
8. Therefore $\angle ABC = \angle BAC$	8. Angles opposite equal sides in a triangle are equal.
9. Therefore $\angle GAE = \angle GBD + \angle ABC + \angle ABC = 3\angle ABC$	9. Equals may be substituted for equals in any process.
10. $\angle ABC = 1/3\angle GAE$	10. Equals divided by equals are equal.
11. $\triangle BXZ = \triangle YAS = \triangle SAT = \triangle TAM$	11. Triangles with their sides respectively equal are congruent.
12. $\angle ABD = \angle YAS = \angle SAT = \angle TAM$	12. Like parts of congruent triangles are equal.
13. $\angle AGE$ is trisected.	13. Any angle divided into 3 equal parts is said to be trisected.

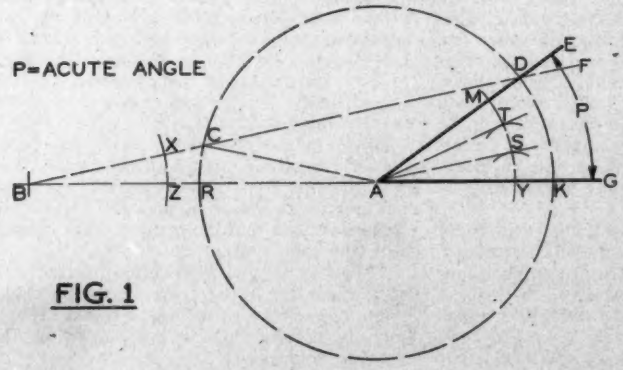


FIG. 1

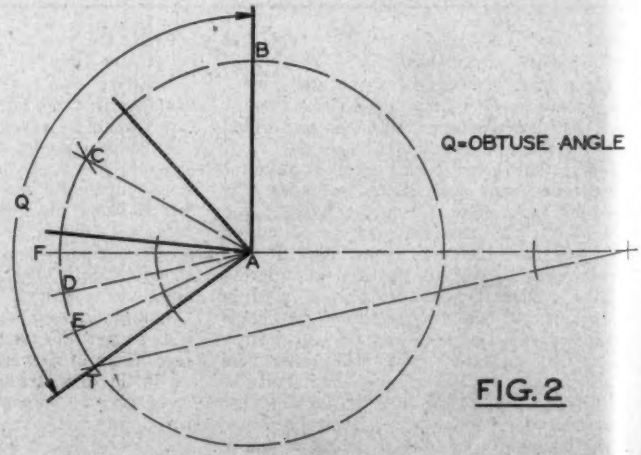


FIG. 2

CABINETMAKING TEST

(Continued from page 64)

46. F	50. T	54. F	58. T	62. T
47. T	51. F	55. T	59. T	63. T
48. T	52. F	56. F	60. T	64. F
49. T	53. T	57. T	61. T	65. T

Incomplete Statements

1. (1)	8. (2)	15. (2)	22. (1)	29. (1)
2. (1)	9. (2)	16. (2)	23. (2)	30. (1)
3. (1)	10. (3)	17. (1)	24. (1)	31. (2)
4. (2)	11. (3)	18. (3)	25. (2)	32. (3)
5. (3)	12. (2)	19. (2)	26. (1)	33. (1)
6. (3)	13. (3)	20. (2)	27. (1)	34. (2)
7. (1)	14. (2)	21. (2)	28. (3)	35. (1)

Personal News

♦ RALPH I. ROGERS, formerly teacher of general metal shop at East Chicago, Ind., has joined the faculty of the Indiana State Teachers College, Laboratory School, at Terre Haute, Ind., as vocational machine-shop instructor and co-ordinator.

♦ LT. EDWIN M. KOOS (jg), who graduated from State Teachers College, California, Pa., with the class of '39, was awarded the Air Medal by the Navy Department for gallant action against an enemy U-boat in the Atlantic, in spite of having been wounded in the leg and hand.

♦ C. M. MILLER, director, Kansas State Board for Vocational Education, was the speaker at the annual breakfast of the Kansas Vocational Association held in Wichita, Kans.

♦ C. L. WETZEL, teacher trainer at the Hadley Vocational School, St. Louis, Mo., is on leave of absence to serve on the War Manpower Commission at Kansas City, Mo.

♦ ERLE HARING, formerly co-ordinator-instructor of the Minneapolis, Kans., cooperative part-time retailing and office program, and until recently with the Midwest Engineering and Tool Company of Neodesha, Kans., has been appointed to fill the vacancy left by W. B. Skelton at Independence, Kans. Mr. Haring began his new work November 22. He will also take charge of the evening school work as well as the co-operative part-time retailing program.

(Continued on page 20A)

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Association News

THE AMERICAN VOCATIONAL ASSOCIATION CONVENTION

The thirty-seventh annual convention of the American Vocational Association was held December 15, 16, and 17, 1943, at Chicago, Ill.

It was truly a convention which contemplated the problem of how vocational education and industrial arts could be most effectively geared to wartime and postwar needs.

Prior to the regular convention, the National Council of City Administrators of Vocational Education and Industrial Arts and Trade School Principals, and the Officers of State Vocational Associations held their deliberations on Monday and Tuesday of the week.

Out of the deliberations it was quite evident that the members of the A.V.A. are in favor of granting educational opportunities to the veterans of World War II, but that they are not in favor of having the supervision of this soldiers' training placed into the hands of noneducational agencies. There are now in existence federal, state, and local school agencies which are well suited to administer this educational program, and the work should be entrusted to these agencies.

The industrial-arts meetings, of which there were four, were all well attended.

The first of these was held Wednesday morning under the chairmanship of V. L. Pickens, director of practical arts, Kansas City, Mo. The entire session was devoted to the theme — "Planning for Post-War Industrial Arts."

The speakers on the program were J. C. Woodin, director of industrial education, Wichita, Kans.; Louis V. Newkirk, director of industrial arts, Chicago, Ill.; and Frank C. Moore, director of industrial arts, Cleveland, Ohio.

The gist of the discussion was that postwar industrial arts must be further extended into the lower grades, and made more available to girls as well as to boys, and that teachers must become more interested in craftwork and become more effective in the lower school levels.

Industrial arts should be truly part of general education and help children to acquire control of their emotions as well as their ability to do things with tools and materials. Industrial arts further should give the child experiences in large areas, such as the manufacturing field, the power field, and the graphic-arts field. To further help the student to the fullest extent, English, science, and mathematics should be correlated with industrial arts.

The Wednesday afternoon section was presided over by R. B. McHenry, director of industrial and adult education, Tulsa, Okla. The speakers on the program were Clifford K. Lush, supervisor of vocational and industrial arts, Minneapolis, Minn.; G. H. Silvius, assistant professor of industrial education, Wayne University, and assistant supervisor of industrial education, Detroit, Mich.; and R. H. Roberts, area training supervisor, War Manpower Commission, Tulsa, Okla.

The discussions set forth that preinduction training aimed at getting the small school to set up industrial-arts courses that really amounted to something. The result up to now is not as good as it might be. Many of the junior high schools as yet do nothing about it, while some of the high schools are aiming at giving more hand tool skills, especially with precision tools. Blueprint reading, electricity, radio, and code work also are more emphasized than formerly, but in many classes there is more seatwork than manipulative work.

Aeronautical industry is making great strides and postwar commerce will be moving at 400 m.p.h. at an altitude of 30,000 ft. above the earth, carrying loads of twenty tons or more.

The greatest number of jobs will be those of maintenance — ground mechanics and crews.

Wartime production work has had its influence on industrial arts and many girls, seeing future possibilities, are entering industrial-arts classes.

The subject of the Thursday afternoon session was under the guidance of Homer J. Smith, professor of industrial education, University of Minnesota, Minneapolis, Minn.

The speakers on this program were Stanley J. Pawelek, supervisor of industrial education, Baltimore, Md.; Harold T. Widdowson, regional supervisor of war-production training, U. S. Office of Education, Washington, D. C.; and E. E. Ericson, director, Division of Industrial Education, State College, Santa Barbara, Calif.

The subjects discussed were "Two Phases of Our Field, Characterization and Comparison"; "Implications for Closer Co-ordination of Effort, Now and Later"; and "Integration of Teacher Preparation and Upgrading While in Service."

At the end of this meeting Arthur B. Mays, professor of industrial education, University of Illinois, Urbana, Ill., presented the following annual report as A.V.A. vice-president representing industrial arts:

"The demands of the war have taken many of the best industrial-arts teachers out of the schools and it is impossible in most cases to find adequately trained substitutes. Hundreds of school shops have had to be closed for the duration of the war. This is serious for the boys and girls but it cannot be remedied in times like these.

"The American Vocational Association has been very active in trying to find ways to promote the industrial-arts work of the schools during the past year. The leaders in all the practical-arts fields are showing unusual interest in the further development of industrial-arts work both now and in the postwar era.

"It is particularly important that more of the states provide state supervision of this work to aid its development in the public schools. There is good prospect that more state departments of education will employ trained supervisors to

(Continued on page 22A)

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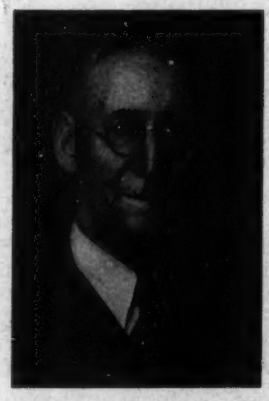
PERSONAL NEWS

(Continued from page 80)

NOTED EDUCATOR DIES

George P. Hambrecht, director of the Wisconsin state board of vocational and adult education, died of a heart attack at his home December 23, 1943.



Dr. Geo. P. Hambrecht

Mr. Hambrecht was born in Milwaukee on February 1, 1871. He attended the University of Wisconsin from 1892–95, and earned the Ph.B. degree at the University of Chicago in 1903, and the LL.B. degree at Yale in 1904. He also studied in Europe in 1922.

He received an honorary Sc.D. degree from The Stout Institute, Menomonie, Wis., in 1932.

Mr. Hambrecht was superintendent of schools in Wisconsin Rapids, Wis., during 1899–1902. In 1903 he was admitted to the bar, and was city attorney of Wisconsin Rapids from 1908 to 1915. He was a member of the Wisconsin House of Representatives from 1909 to 1915, and became a member of the Industrial Commission of Wisconsin in 1915. He served in this capacity until he was appointed state director of vocational and adult education on July 1, 1921.

He held many other civic appointments in the state, and is known as a prolific writer on educational subjects. He wrote several books on Abraham Lincoln, and had a private collection of more than 3000 volumes and pamphlets on Lincoln.

His death came as a distinct shock to his many friends in the field of vocational education, many of whom had met and conversed with him at the American Vocational Association convention held at Chicago less than a week before his death.

DR. F. THEODORE STRUCK DIES

It is with great sorrow that many readers of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION will learn of the death of Dr. F. Theodore Struck, who died suddenly during the month of November, 1943.

Dr. Struck was born in Hamburg, Germany, March 18, 1886, and came to this country with his parents in 1893. He received his early education at Hood River, Ore.

The University of Oregon granted him his B.S. in C.E. in 1911. He earned the M.A. degree at Columbia in 1914, and the Ph.D. degree at the same institution in 1920.

He taught shopwork and drawing at Tacoma, Wash., from 1911 to 1913; was director of the Vocational School at West Orange, N. J., from 1914 to 1915; head instructor at the Essex County Vocational School for Boys from 1915 to 1918; was associate professor and professor of agriculture at Pennsylvania State College from 1918 to 1920; director of vocational education of the Pennsylvania State Department of Public Instruction from 1920 to 1926; and professor of industrial education and head of the department at the Pennsylvania State College, State College, Pa., since 1926.

Dr. Struck also served as summer school lecturer and instructor at numerous teacher-training institutions.

He held membership in many educational associations, and served on numerous important boards and committees.

Dr. F. Theodore Struck

He is also the author of a number of professional books and was a constant contributor to periodicals in the educational field.

This kind, scholarly man will be sorely missed by thousands of teachers in industrial arts and vocational education who have studied under him or have met him in their work of training the future workers of this country.

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(Continued from page 18A)

further develop industrial-arts work during the years ahead.

"The American Vocational Association is doing everything possible, that is, in keeping with sound educational practice, to lay plans for and to encourage an enlarged program of industrial-arts activities in the public schools of the nation. The growing interest in this phase of school-work both by pupils and the general public indicates an unprecedented growth when the war ends.

"Industrial-arts teachers are looking to the A.V.A. increasingly for aid in developing their services to the boys and girls of America and as this organization grows in numbers its ability to give aid to the teachers is greatly strengthened. The prospects for 1944 are extremely encouraging."

(*Report to be continued*)

♦ At the 32nd National Safety Congress held in Chicago during the month of October, the following officers were elected to act as the executive committee of the Child Education Section for the year 1943–44.

General Chairman: Mary May Wyman, supervisor, Health and Safety Education, Louisville Public Schools, Louisville, Ky.

Vice-Chairman: Gordon C. Graham, supervisor, Safety Education Department, Board of Education, 467 West Hancock, Detroit, Mich.

Chairman, Committee on Teacher Education for Safety: Herbert J. Stack, director, Center for Safety Education, New York University, New York, N. Y.

Chairman, Committee on Congress Program: Mae Heathershaw, principal, Kirkwood Monroe Schools, Des Moines, Iowa.

Chairman, Committee on Curriculum Planning for Safety: George H. Reavis, assistant superintendent of schools, Cincinnati, Ohio.

Secretary: Marian Telford, director, School and College Division, National Safety Council, Inc., 20 N. Wacker Drive, Chicago 6, Ill.

♦ The industrial-arts department of Miami, Fla., held an all day fellowship teachers meeting on October 1, at which Mr. Williams presented "A Résumé of the Historical Background of Industrial Arts." F. J. Gottwald spoke on "Educational Opportunities and an Outline of a Course in Home Repairs." F. W. Taylor presented his views on "An Outline of a Course in Junior High School Drafting," and O. E. Monninger gave an address on "Management and Control in the Junior High School Shop."

A general discussion followed the addresses.

♦ The New Jersey Vocational and Arts Association will hold its annual convention on January 22, 1944, at Hotel Alpine, New York City.

The secretary of this association is J. J. Berilla, 549 Corliss Ave., Phillipsburg, N. J.

♦ The Illinois Vocational Association will hold its 1944 convention at the Abraham Lincoln Hotel, Springfield, Ill., Friday and Saturday, April 14 and 15.

♦ Among the many who attended the annual dinner and business meeting of the California Schoolmasters' Club, held at the Claremont Hotel in Berkeley, Calif., on Tuesday, November 23, 1943, was a group of forty vocational men from the Oakland school department. Mr. Harold N. Wright, supervisor of war-production training, had as his guests, Lt. Com. John C. Mitchell, in charge of the Radar School, Alameda Naval Training Station; Lt. Com. E. R. Booker, supervisor of shipbuilding on the Pacific Coast for the Navy; Chas. W. Page, special state supervisor of war production; Carl Keller, special supervisor of war-production training; Grant Wiswell, Pacific Coast superintendent of Westinghouse Electric & Mfg. Co.; Walter Smithen, superintendent of electrical division, General Engineering & Drydock Co.; Frank Corker, director of training, Moore Drydock Co.; Chas. W. Patrick, area training supervisor, War Manpower Commission; and Ortho Moore, supervisor of war-production training, Richmond, Calif. Attending also were Kenneth Ferrell, Robt. E. Gilbert, M. H. Maddern, and Thos. E. Cole, assistant supervisors of the war-production training program of Oakland. The address of the evening "After the War, What Then?" was presented by Mr. Chas. L. Wheeler, vice-president and general manager of the McCormick Steamship Company.

♦ The industrial-arts section of the Southwestern Ohio Teachers Association met for their annual luncheon and meeting on October 29, 1943, at the Hotel Gibson, Cincinnati, Ohio. Mr. Henry C. Letsinger, chairman of the association, presided at the meeting.

Among the speakers on this occasion were Elmer W. Christy, director of industrial arts, Cincinnati; John A. Whitesel, Miami University, Oxford, Ohio; Towne Abercrombie, instructor from Washington Junior High School, Cincinnati; Glenn Wise, who spoke on behalf of the American Industrial Arts Association; Richard Crow, formerly of the Industrial-Arts Laboratory of Greenhills, and now affiliated with the Curtiss-Wright Corp., of Columbus, Ohio; Dr. William Stoner, of Miami University, Oxford, Ohio; and Sylvan Yeager, Indiana State Teachers College, Terre Haute, Ind.

Officers for the present school year are John Whitesel, chairman and Herbert Richter, secretary-treasurer. Ray Kenney of Elmwood Place School reported for the committee. Other members were Charles Reichle, Norwood; and John Bigler of Cincinnati.—*Ray Holbe*, secretary.

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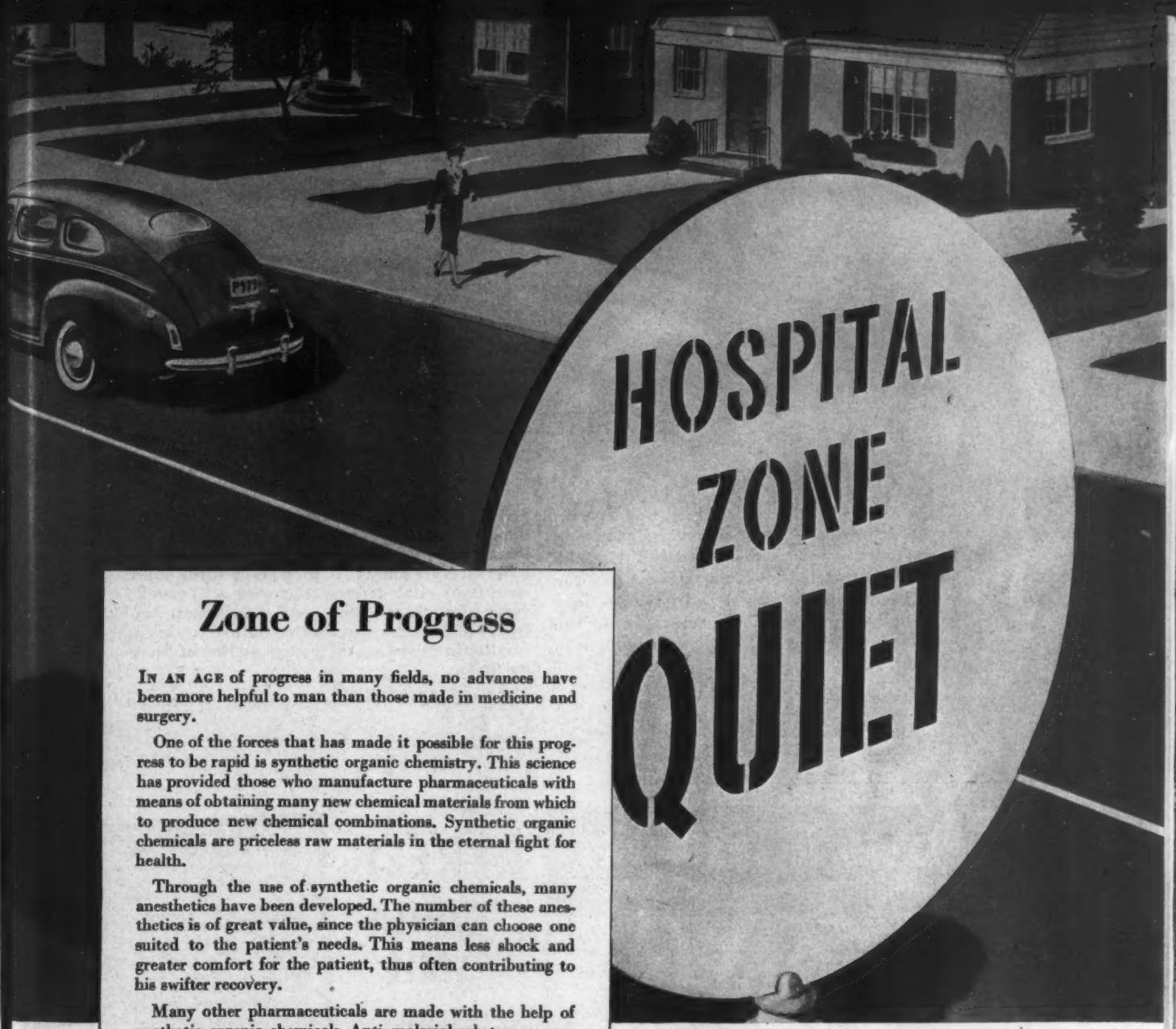
News Notes

♦ War needs have produced veritable miracles of mechanical and electrical contrivances. A gyro, for instance, used to satisfy one of the many war needs, must have its flywheel come to the full speed of 12,000 r.p.m., in two tenths of a

(Continued on page 25A)



Zone of Progress

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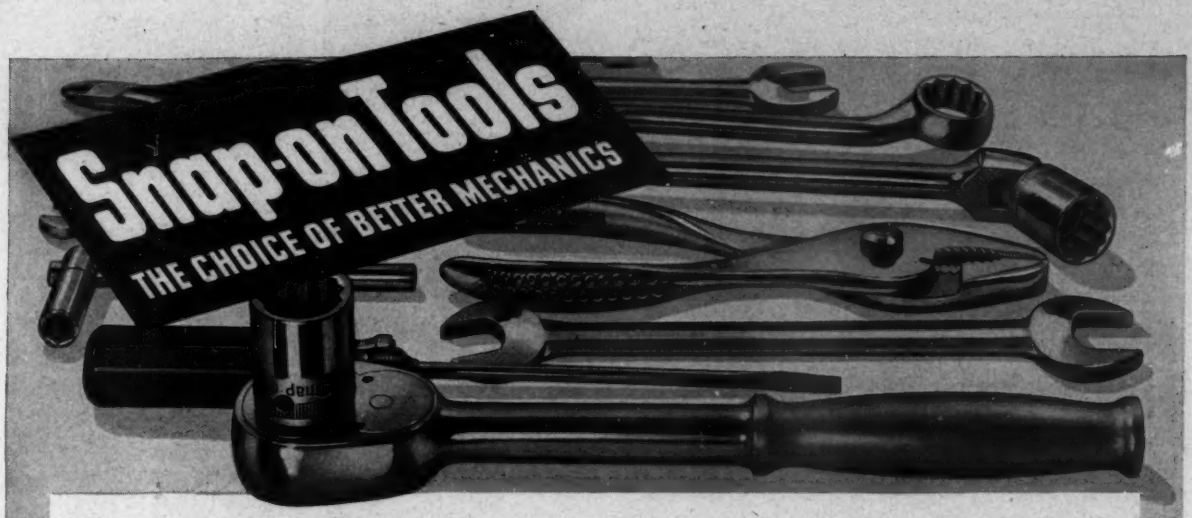

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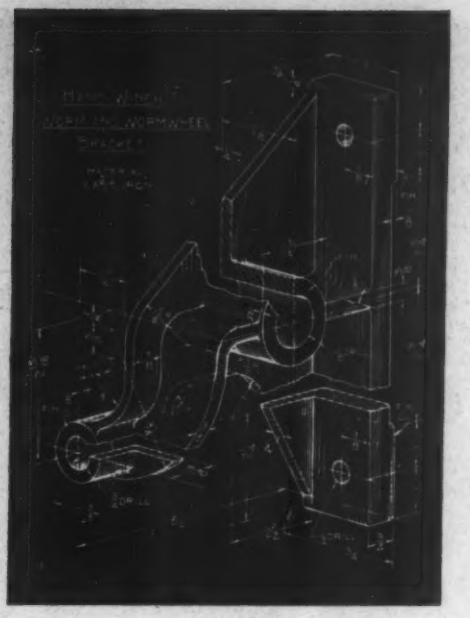
Let those technicians of tomorrow try their hands at a real practical problem—drawing the correct orthographic views of this Hand Winch. This kind of practice will help them a lot in learning how to read blueprints, something they'll have to be able to do in the service.

At the same time, get them into the good habit of using Typhonite Eldorado Pencils for their working drawings. They'll find that the sharp, dense, uniform lines made by this professional draftsman's tool translate into clean blueprints that are easy to read and a credit to the drawing. Typhonite Eldorado will help give them pride in their work as well as valuable experience.



SOLUTION: We will send you a free blueprint showing the solution of this problem. Write to the address below within thirty days. Specify Blueprint No. 128-J2.

TYPHONITE

ELDORADO

SCHOOL BUREAU, PENCIL SALES DEPT., JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

(Continued from page 22A)

second. The motor developed for this gyro by the Westinghouse engineers is about the size and shape of a beer bottle. It weighs 10½ lb., and develops 22 h.p.

♦ The war-training division of the Detroit Public Schools has taken over the training of motormen and coach operators for the department of street railways. This training will be financed with federal funds as a part of the vocational training for war-workers.

♦ The 1943 outbreak of infantile paralysis is said to be the worst in 12 years. This strongly emphasizes the need of supporting the annual fund-raising appeal of the National Foundation for Infantile Paralysis.

♦ Kennametal, Inc., 305 Lloyd Ave., Latrobe, Pa., has developed a file made of cemented carbide composition which permits filing of cast iron and brass at surface speeds of 900 f.p.m., and high-carbon and high-chromium steels at 800 f.p.m.

♦ Six 4-H Club members received $200 college scholarships at the 4-H Club Congress held at Chicago on December 1, for excelling in rural electrification projects.

The awards were presented by the Westinghouse Electric and Manufacturing Company. The six national scholarship winners were selected from the group of state title holders on the basis of self-prepared reports concerning their electrical studies and projects.

♦ The Division of Vocational Education, Baltimore, Md., is offering electric welding and radio courses during the daytime for night-shift workers in local plants.

♦ According to the U. S. Office of Education, public vocational schools in approximately 100 cities are conducting short, intensive courses under the program of Vocational Training for War-Production Workers for men and women recruited for jobs in the motor transportation industry.

Estimated employment needs, including expansion and replacement needs, of motor transportation lines are approximately as follows: 361,000 workers for trucking lines; 27,000 workers for intercity bus lines; 70,000 workers for local motor transportation lines.

♦ The Society for Visual Education, Inc., 100 East Ohio St., Chicago 11, Ill., announces additional silhouette slides of the following five aircraft: 118 Lockheed Hudson (A–39, PBO); 119 Boeing Sea Ranger (PBB); 120 Heinkel He–113; 121 Heinkel He–115; and 122 Fieseler Storch (Fi–156K).

New Publications

Basic Aircraft Construction

By Ross A. Peterson and Raymond E. Erickson. Cloth, 204 pages, 5¼ by 7½ in., illustrated. Price, $2. Prentice-Hall, Inc., New York City.

A basic training course for those who want to enter this field. The text is divided into eight parts which lead the student through a study of the component parts of the airplane; show him how it is produced; teach him how to read blueprints and how tools, jigs, and fixtures are used in production shops; give him an understanding of the main materials used; and show him how the machine and sheet-metal shops function in the production of the airplane; and how riveting is done.

The appendix contains a number of tables found useful by those working in aircraft construction.

Shipfitting Simplified

By L. L. Oberman. Loose leaf, imitation leather, 126 pages, 5 by 7⅜ in., illustrated. Price, $1.25. McGraw-Hill Book Co., New York City.

An attempt to handle this subject briefly and without making it too technical. It covers the construction, the prefabrication of units, the various symbols used on blueprints from which the shipbuilder works, the routine followed in getting out and assembling the material needed for building a ship, safety precautions, the actual procedure of building, and finally, a glossary of shipbuilding terms.

Pocket Manual of Arc Welding

Paper covered, 128 pages, 4⅝ by 7⅜ in. Price, 50 cents. Published by The Industrial Publishing Co., Cleveland, Ohio.

This handy little manual contains much useful information for the practical arc welder. It discusses polarity; expansion, contraction, and distortion; a.c. and d.c. welding; welding of various kinds of metals; metallurgy applied to welding; surfacing by arc welding; welding sheet metal and galvanized steel; inspecting and testing; studying welding costs; efficient use of electrodes; selection of electrodes; care of equipment; determination of type of joint; welding speeds; and the like.

The booklet also contains a glossary of terms, and the welding symbols commonly used.

Graphic Bookbinding

By Louis J. Haas. Paper covered, 13 pages, 7 by 10 in. Price, 50 cents. Published by Louis J. Haas, 3 Gedney Terrace, White Plains, N. Y.

Thirteen full-page instruction sheets which give full explanation on how to rebind and repair books and book covers.

Each step is illustrated by a sketch, and the directions are given concisely and clearly.

Shop Mathematics

By Arthur A. Dick. Cloth, 230 pages, 5½ by 8⅛ in., illustrated. Price, $2.40. The Ronald Press, New York City.

Related mathematics designed to fit the immediate needs of students taking technical and vocational subjects on the high school level.

The book covers arithmetical fundamentals, algebraic equations, geometrical computations, and practical trigonometry.

The appendix contains a number of useful tables.

(Continued on next page)

(Continued from previous page)

The Technique of Handling People

By Donald A. and Eleanor C. Laird. Cloth, 139 pages, 5¾ by 8⅛ in. Whittlesey House, McGraw-Hill Book Co., New York City.

A treatise on how to win, rather than to antagonize; to find good traits in people rather than faults; to get cooperation by friendliness rather than by show of authority or power.

Freehand Drafting

By Anthony E. Zipprich. Cloth, 149 pages, 6¼ by 9⅛ in., illustrated. Second edition. Published by D. Van Nostrand Co., Inc., New York City.

In these days of frenzied production, freehand drafting may serve many purposes. This book shows many fine examples of how freehand drawing may be used to satisfy given requirements.

Iron Men and Their Dogs

By Ferdinand C. Latrobe. Cloth, 225 pages, illustrated. Put out by the Horn-Shafer Co., Baltimore, Md.

Shop Equipment News

New Products — Publications

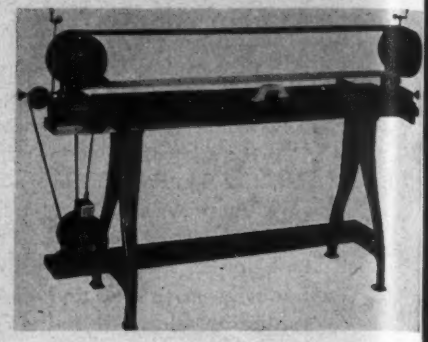
A NEW COMPACT BELT SANDER

A new, compact, mill-type, hand-stroke belt sander is being offered by Boice-Crane Co., 932 Central Ave., Toledo, Ohio.

A large, free-rolling worktable handles surfaces 36 in. wide, 60 in. long, and any length stock up to 12 in. wide. It will accommodate all flat and contour metal, fiber, wood, or plastic parts.

Complete control, from light *spot* touch-ups to heavy *all over* cuts are made possible.

An exclusive Height-O-Matic V-belt drive automatically maintains drive belt tension.



New belt sander

Multiple fixtures can be attached to the table so as to take dozens of small parts at a time.

The sanding belts are 6 in. wide.

For brief reference use IAVE—210.

CHART ON GLUE SPECIFICATION

The Casein Company of America, Division of the Borden Company, 350 Madison Ave., New York 17, N. Y., have issued a new edition of their chart called "Glue Recommendations for U. S. Government Specifications." It supersedes the previous edition dated last December. The new chart is a compilation of current information on glues, and is a short course in modern gluing. It illustrates two important trends:

1. The number of new specifications illustrates the growing acceptance of glued wood as a war-production material.

2. Three new specifications denote official recognition of a brand new type of glue — non-acid, low temperature phenol resin. This is the glue that makes possible joint gluing and laminating with the same maximum durability obtained in the finest hot press plywood. Cascophen Lt-67 is, as far as is known, the only glue which complies with these specifications.

A copy of the chart may be obtained by writing to the Casein Company.

For brief reference use IAVE—211.

NEW IMPROVED LOCK-TYPE PROTRACTOR

Xactor, the new pocket-size, lock-type protractor is specially designed for the fields of expert engineering, tool grinding, machine work, and inspection. It is equipped with a vernier and assists in accurately measuring angles of drill points, tool bits, machine ways, depths of deep holes; for sketching and laying out tools and machine parts, dies, and jigs; and inspection of manufactured parts.

For prices and descriptive literature, write Industrial Engineering Co., Inc., 141 West Jackson Blvd., Chicago 4, Ill.

For brief reference use IAVE—212.

NEW COIL-WINDING AND RF RESONANCE CALCULATOR

Allied Radio Corporation, 833 W. Jackson Blvd., Chicago 7, Ill., announces the release of a new slide-rule type rapid calculator, permitting quick and accurate determination of inductance, capacitance, and frequency components of series or parallel tuned RF circuits as well as inductance, turns per inch, wire type, wire size, coil diameter and coil length for single layer-wound solonoid type RF coils. All values, in either case, are found with a single setting of the slide and are accurate to within approximately 1 per cent for coils ranging from ½ in. to 5½ in. in diameter, and ¼ in. to 10 in. in length. All possible combinations within these limits are shown.

(Continued on page 35A)

Filing Hints to meet war-time needs

HELLER MADE IN U.S.A. ZDUDH

KEEP FILES *Away* FROM MOISTURE

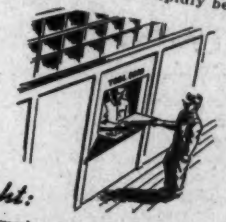
UNLESS FILES are given the proper care that should be accorded any good cutting tools, they will soon become useless long before their time. It is well to impress this fact on the beginner right from the start.

Protect files when not in use. In particular, do not let them lie in places where they will be exposed to moisture. Water causes rusting and rapid deterioration. Files should always be kept in a dry place that is free from moisture.

☆ ☆ ☆

Since for over 100 years the policy of Heller Brothers Company has always been to manufacture files that give the finest file performance obtainable, the patented "Wavy Teeth" design has, at a higher cost to the maker but at no higher price to the user, been incorporated in NUCUT Files.

Wrong: Do not leave files in a moist place, as they will rust and rapidly become useless.



Right: Have workmen return files to the tool crib when they are through with them.

HELLER BROTHERS COMPANY • Newark, N. J. • Newcomerstown, Ohio

America's Oldest File Manufacturers — Good Tools Since 1836

Awarded to the Newcomerstown, Ohio, Plant

HELLER NUCUT WAVY TEETH FILES

PATENT No. 2027039

Aircraft Industry Alone Needs 1,500,000 Trained Workers—*At Once!*

Workers are trained faster with...

DITTO

Trade Mark Reg. U.S. Pat. Off.

Write TODAY on your letterhead for FREE copies of folders explaining new DITTO teaching methods. You'll find them invaluable in your work of training workers. Address DITTO, Inc., 650 South Oakley Blvd., Chicago 12, Illinois.

Today, as always, genuine DITTO supplies are available for keeping previously purchased gelatin and liquid type machines operating at top efficiency.

"Manpower!"... American war plants need *trained* help by the millions! The aircraft industry is one of thousands now being served by DITTO which *must* have trained men and women in order to meet production schedules that are greater than ever before!

Help your students to be of even greater service to war industry!... Give them the facts about DITTO machines and methods. Acquaint them with DITTO Systems which today are speeding every plane, every tank and every ship to fighting fronts faster!

DITTO, Inc., 650 South Oakley Blvd., Chicago 12, Illinois

WEIDENHOFF

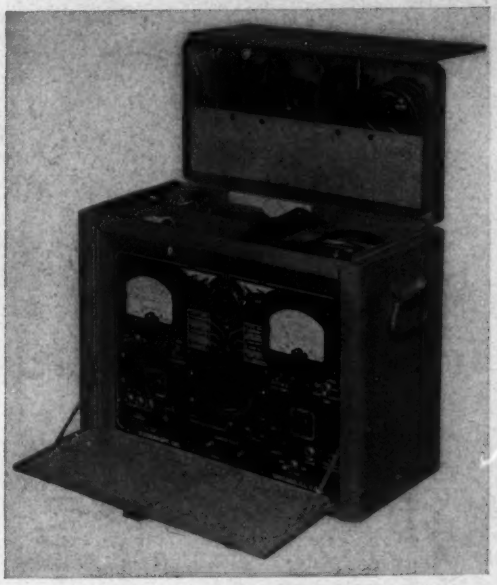
Automotive - Aviation

SERVICE EQUIPMENT

TAKE CARE OF YOUR EQUIPMENT

The greatest good is obtained from automotive electrical testing equipment if a little time is taken to keep it in good operating condition. Equipment of this kind incorporates many precision built units which should be carefully protected to insure accurate results over long periods of use. School instructors are urged to check up on the condition of their Weidenhoff equipment particularly now when school activities are getting under way.

Below are given a few timely suggestions that will help to attain the results desired. These precautions will help to keep test equipment at peak efficiency and reduce the need for maintenance.



MODEL 1019 ENGINE ANALYZER

A fully illustrated treatise on automotive electric systems, magnetism, battery ignition and high-tension magnetos.

Sent FREE for limited time to instructors requesting it on their letterheads. Regular price $1.50 each.

SOME TIMELY TIPS

All switches of a test bench or other apparatus should be in the OFF position when the equipment is not in use. It provides protection to the meters.

Be exceedingly careful of voltmeters, ammeters, etc. They may be damaged and replacement may be impossible.

Take exceptionally good care of all test leads. Keep them free from oil and grease.

If amperage or voltage is to be checked be sure to select a scale high enough so the meter will not be damaged.

At regular intervals wipe off any trace of moisture and keep the equipment in a dry place. Your testing equipment will have to do for the duration. Conserve it in every way possible.

KEEP BUYING WAR BONDS AND STAMPS

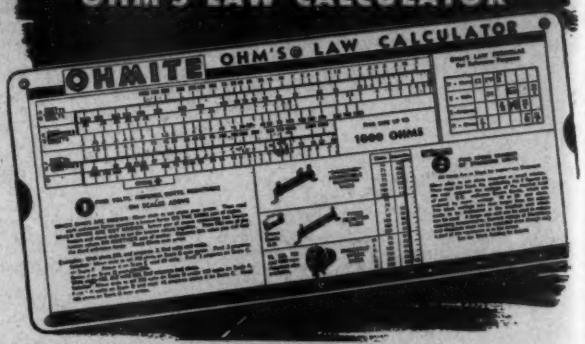
JOSEPH WEIDENHOFF, INC., CHICAGO 24, ILL., U. S. A.

TEST BENCHES ENGINE ANALYZERS BATTERY CHARGERS MAGNETO TESTERS ELECTRICAL TESTING & SERVICE EQUIPMENT

SEND FOR THIS HANDY

OHMITE

OHM'S LAW CALCULATOR



Solve Electrical Problems—Faster, Easier

Thousands used in the training program today. Helps students figure ohms, watts, volts, amperes—quickly, easily. Solves any Ohm's Law problem with one setting of the slide. No slide rule knowledge necessary. All values are direct reading. Two sides cover the range commonly used in electrical and radio work. Size, only 4⅛"x9". Send only 10c in coin to cover handling cost.

TEACHERS—Write for information on how you can obtain a quantity of these Calculators for your students at a special price.

OHMITE MANUFACTURING CO.
4852 Flournoy St., Chicago, U. S. A.

STRONG, EVEN *DURABLE* WELDS

with

KNOCK-OUT ARC WELDERS

- LOW INITIAL COST
- LOW OPERATION COST
- POSITIVELY SILENT
- NEGLIGIBLE UPKEEP
- BURN OUT PROOF
- TRANSFORMER

WRITE FOR BULLETIN W42-1A

KNOCK-OUT

K.O.LEE COMPANY
ABERDEEN, SO. DAKOTA

Enter the HIGGINS SCHOLASTIC AWARDS NOW and win a prize . . . gift . . . scholarship.

Three fields are open — free-hand drawing, mechanical drawing, and cartooning. Students in junior high and high schools are eligible to compete for the thirty cash prizes, thirty gifts, and many scholarships. Material submitted will be judged in Pittsburgh and should be sent to: Scholastic Awards, Chamber of Commerce Building, Pittsburgh, Pennsylvania, before March 25. For further information ask your art teacher or write at once to the Higgins Ink Co., Inc., sponsors for fifteen years of Scholastic Awards and makers of the famous Higgins American Drawing Inks.

HIGGINS *INK CO., INC.*
271 NINTH ST., BROOKLYN 15, N. Y., U. S. A.

ASK ABOUT THE NEW CARTOONING DIVISION

Minnesota

SUMMER SESSION

Department of Industrial Education
COLLEGE of EDUCATION

★

Separate Enrollment for Either or Both Terms

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Four-year Curriculum — B.S. Degree
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Industrial Arts and
Smith-Hughes, George-Deen Courses
Excellent Library Facilities
Unexcelled Recreational Program
Wide Range of Manipulative Courses

★

Correspondence concerning credit transfer, graduate status, and advanced programs, should be addressed to the Department of Industrial Education, 200 Eddy Hall. Four-year curriculum and graduate patterns upon request.

Bulletins of the Summer Session may be obtained by writing to the Director of Summer Sessions,
709 Administration Building

UNIVERSITY OF MINNESOTA
Minneapolis, Minnesota

BASIC SHOP TEXTS

GENERAL PRINTING

Cleeton & Pitkin

A new text called by instructors who have seen it the "best book published on printing." Each fundamental operation is illustrated by close-up illustrations. $1.60.

GENERAL DRAFTING

Fryklund & Kepler

Describes fundamental operations and tells how to perform them. Special units on electrical, sheet metal, radio, architectural drafting. $1.00.

GEN. SHOP WOODWORKING

Fryklund & LaBerge

A standard text for beginning students. Covers basic fundamentals in hand woodworking. Contains suggestions for designing practical projects. $ .80.

GEN. SHOP ELECTRICITY

Dragoo & Dragoo

A text embodying the fundamentals of electricity. Consists of wiring diagrams, circuit layouts, and other interesting electrical projects. $ .80.

McKnight & McKnight
BLOOMINGTON, ILLINOIS

We Bore The First Hole—In A Hickory Slab

THIS is one of the hundreds of tough hickory slabs used each year to give Russell Jennings Auger Bits actual boring tests before shipment. No mercy is shown in this test—no bit escapes it! Because of this, there can be but one result: *uniform quality performance.* Only the best tool steel is used. The screws are accurately centered. The hole sizes are exact. But then—more than 90 years' experience backs the genuine Russell Jennings Auger Bit!

Russell Jennings AUGER BITS

THE RUSSELL JENNINGS MFG. CO., CHESTER, CONN.

★ ★ ★ ★ ★ ★ ★ ★ ★

Investigate these Star Tools

Use inexpensive staple tacks. List Price $6.00

STAR AUTOMATIC TACKERS

The Best Way to Tack Things

Used in industrial production work. Tack upholstery, wire screens, shades on rollers, dozens of other uses. Easy to operate — just squeeze the handle. Hold material in place with one hand, tack it with the other. Tack within 1/16" of an edge and in close quarters where you can't swing a hammer.

STAR Model S122P Stapler

A stapler and light tacker combined. Handy — fits in pocket. Squeeze it to staple papers — Holds 105 Standard Staples.

USED AS A TACKER

Swing the base down and around and it becomes a light duty tacker. Fine for tacking up charts, pictures and papers on walls, drawings on drawing boards.

List Price $1.90

Write for special offer to readers of this magazine. Send For catalog of the Star line of tackers and paper fasteners.

★ Star Paper Fastener Co.

NORWALK Dept. AE CONNECTICUT

★ ★ ★ ★ ★ ★ ★ ★ ★

WEBER

DRAWING MATERIALS

A COMPLETE LINE for MECHANICAL DRAWING CLASSES:

- DRAWING INSTRUMENTS
- DRAFTING SUPPLIES
- DRAWING INKS
- DRAFTING ROOM FURNITURE

CATALOGUE VOL. 700 TO SCHOOLS AND TEACHERS, ON REQUEST

F. WEBER CO.

PHILADELPHIA 23, PA.
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Full Protection

— for vital parts of airplane engines and other mechanical equipment of this mechanized war is provided by envelopes.

Envelopes are important today not only as mail carriers, but as *packages.* That's why envelopes deserve an important part in your printing curriculum.

WESTERN STATES ENVELOPE CO.

1616 W. Pierce Street, Milwaukee 4, Wisconsin

WALLACE
"MACHINE-OF-THE-MONTH"

No. 11
UNIVERSAL SAW

Direct Gear Drive. Motor raises, lowers, tilts — table remains horizontal. Micrometer rip fence for fast set-ups and close work. Two mitre gauges, adjustable for accuracy and wear. Motors to 2 H.P.

Here's a variety saw with value *plus* — a precision unit for accurate work, with extra capacity for those hard-to-handle jobs.

It has power, speed, stamina. Blades up to 11" cut 4" deep. Cross-cutting capacity, 14". Ripping capacity, 12", 24", 36" or 48". Quality materials guarantee long, trouble-free service.

Write today for bulletins. We also manufacture high-grade bandsaws, jointers, cut-off saws, mortisers, lathes, shapers, grinders, glue pots, etc.

J. D. WALLACE & COMPANY
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COLUMBIAN VISES

★ Tools play an important part in producing craftsmanship. The finer the tool, the better the craftsmanship.

The vise is the most important tool on the bench. It undoubtedly is a COLUMBIAN, because all are made to the highest standards of engineering and workmanship. COLUMBIAN VISES are the leaders in the field. There's a COLUMBIAN VISE for every need and purpose.

Columbian Continuous screw Woodworker's vises are furnished with hard wood handles — or may be equipped with ADJUSTABLE STEEL HANDLES, as above, to eliminate handle breakage, speed operation and provide extra leverage.

Columbian Machinist's Vises are made of malleable iron castings, guaranteed unbreakable, and designed to provide accurate, dependable equipment for school and industrial shops. All standard types.

Awarded April 8th, 1943
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THE COLUMBIAN VISE & MFG. CO.
9022 BESSEMER AVENUE CLEVELAND 4, OHIO
THE WORLD'S LARGEST MAKERS OF VISES

Teach Him Today

. . . with the glue he'll be using in his work tomorrow!

TODAY, a waste-basket in a classroom; tomorrow an airplane, boat assembly or any of the thousands of industrial uses of Weldwood Plastic Resin Glue.

The knowledge that your student gains now in the use of this modern adhesive will be a valuable asset to him when he goes out on his own.

In manufacturing plants all over the country, Weldwood Glue is being used for its very definite advantages in permanently welding wood to wood.

Approved by the U. S. Army, Navy, Maritime Commission and Civil Aeronautics Authority, Weldwood Glue has tremendous strength. Fully waterproof, it is used cold and sets cold.

It is a fine powder and forms a smooth, easily spread paste simply by mixing with ordinary tap water. Can then be used at once and sets so fast work can be handled in a few hours.

Stain-free and odorless, it is available in 1⅛ oz., 3½ oz., 8 oz. and 1, 5, 10 and 25 lb. cans and 100 lb. drums from your supply dealer. For full information, literature and FREE sample can, mail the coupon below.

"Makes the Glue Line the SAFETY Line"

WELDWOOD WATERPROOF GLUE

UNITED STATES PLYWOOD CORPORATION
Weldwood Glue Dept. 29,
55 West 44th Street, New York 18, N. Y.
Please send literature, prices and *free* sample of Weldwood Glue:—

Name _____ *Position* _____
School _____
Address _____
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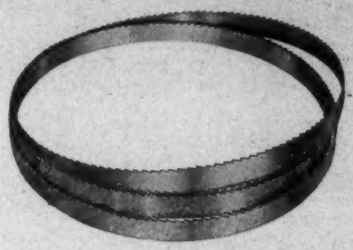


A FINER BAND SAW

. . . Proven in Service

Woodworking plants praise the extra toughness and stamina that keeps these blades cutting right through high production schedules. Made in all standard widths from 3/16" to 1¼". Available in coils or cut to length and joined.

Write for quotation on these and other fine circular and hand saws for your woodworking shop.

OHLEN BISHOP MANUFACTURING CO.

909 Ingleside Ave. ... Columbus, Ohio

OHLEN-BISHOP SAWS

MASTER SAW MAKERS SINCE 1852

"DIE-LESS" DUPLICATING

SAVES MAN HOURS AND DELAYS

DIE ACCURACY WITHOUT DIES

Send for CATALOG

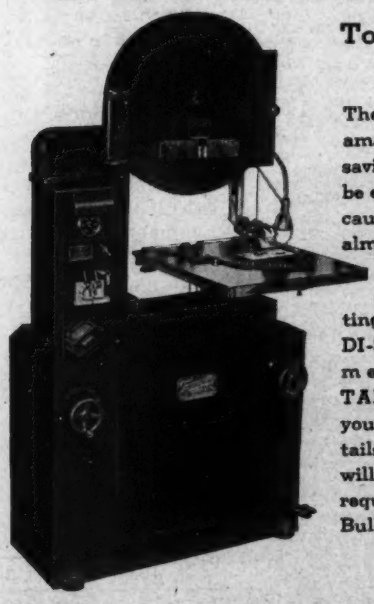
DI-ACRO PRECISION MACHINES — DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

351 EIGHTH AVE. SOUTH, MINNEAPOLIS 15, MINN.

Tannewitz DI-SAWS

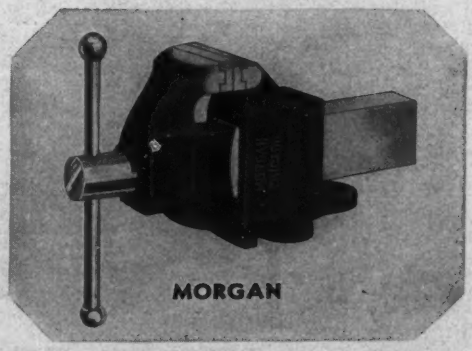
are ESSENTIAL to Teaching MODERN Tool & Die Making



The innumerable and truly amazing time and money-saving shortcuts which may be effected by DI-SAWING is causing this equipment to be almost universally adopted by the leading shops. For inside and outside cutting, filing and polishing the DI-SAW is obsoleting other methods. Put the TANNEWITZ DI-SAW on your MUST list. Complete details of this exellent machine will be sent you promptly on request. Just ask for DI-SAW Bulletin.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

Compare MORGAN VISES

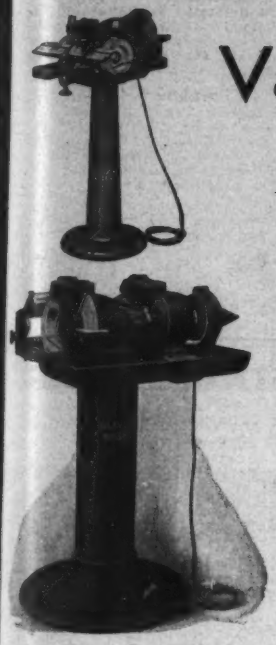


Morgan vises can be had in various sizes and styles for woodworking, machine, automotive and electric departments in school shops and will give years and years of service.

MORGAN VISE COMPANY

120 N. Jefferson Street — Chicago 6, Illinois

OLIVER



Variety Tool Grinders

"Oliver" Oilstone Tool Grinders are compact, sturdy, and efficient machines, especially adapted to schoolshop needs. No. 384 and No. 585, pictured here, are equipped with adjustable tool holders, right angle tool rest, motor, ball bearings, and push button switch.

For further information, write for descriptive circulars.

OLIVER MACHINERY COMPANY
GRAND RAPIDS MICHIGAN

HARGRAVE Tested Tools

PREFERRED BY INDUSTRY and Schools SINCE 1879

Built to stand the hard, everyday grind of production work, Hargrave Tools have been accepted for more than 64 years as leaders in their field. Over this lengthy period, many improvements have been worked out, with the aid of skilled mechanics from some of the nation's largest plants—resulting in tools of the finest workmanship, durability and efficiency.

Write for Catalog showing our complete line of Clamps, Chisels, Punches, Bench Anvils, Saw Vises and other tools for the SCHOOL SHOP.

SEE YOUR SUPPLY HOUSE or write Dept. VO for information.

The CINCINNATI TOOL Co.
Est. 1879 CINCINNATI 12, OHIO

Teach Good Soldering With RUBYFLUID

These special Soldering Fluxes offer many working advantages. You'll find that good soldering and tinning is easier to teach, and students learn more quickly, with RUBYFLUID.

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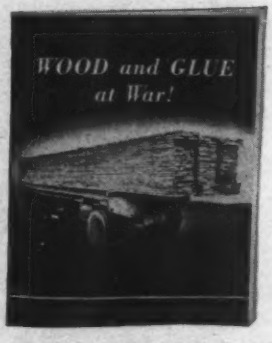

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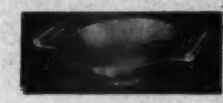

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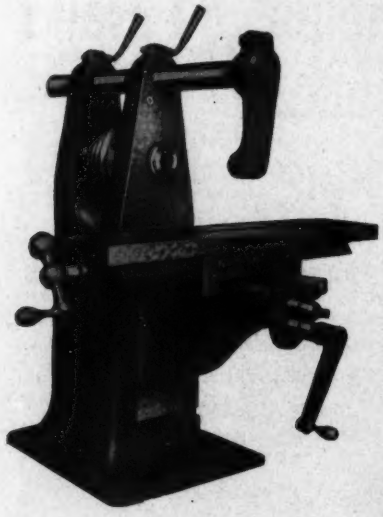

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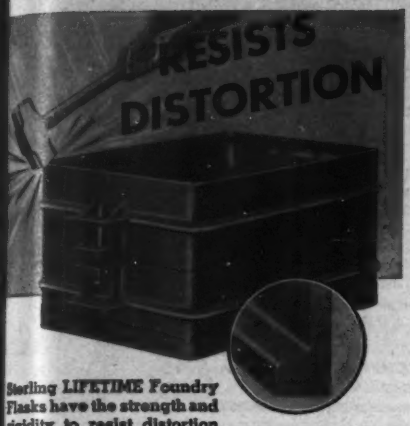

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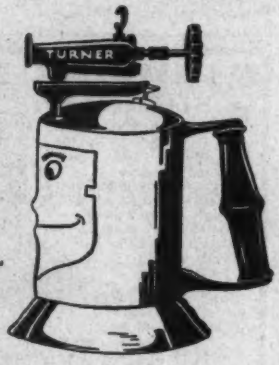

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For brief reference use IAVE—213.

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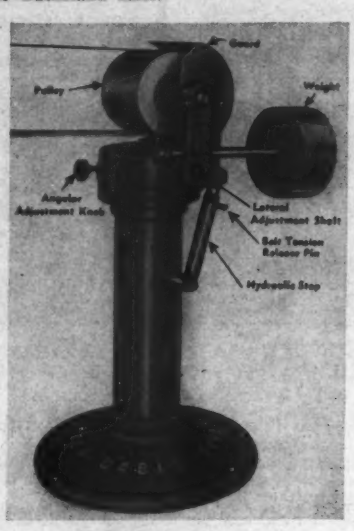

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IDEA STIMULATORS FOR THE DESIGNER

A new data service in loose-leaf form, entitled "Practical Design for Arc Welding," is being released by The Hobart Brothers Co., of Troy, Ohio, manufacturers of electric arc welding equipment.

The design plates are in loose-leaf form to fit standard files or binders. These new sheets offer suggestions that are applicable to a large number of projects; hence, the matter of size and detailed specifications are left open to be determined by the designer in each case, to meet the requirements of the purpose at hand.

For brief reference use IAVE—215.

ARMY ORDNANCE CITATION

In recognition of his contribution to armament production, an Army Ordnance Citation has been made to Carl W. Noffke, tool engineer of E. C. Atkins and Company. The citation was presented in brief ceremonies at the Atkins plant by Lt. Col. G. M. Enos on behalf of Major General L. H. Campbell, Jr., Chief of Ordnance, Washington.

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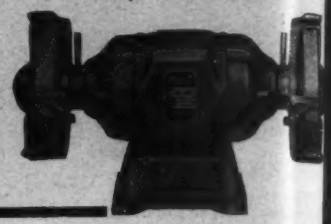

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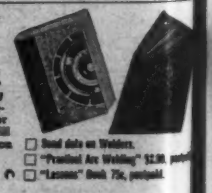

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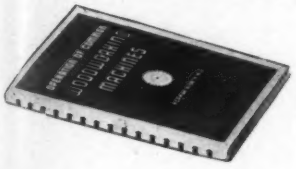

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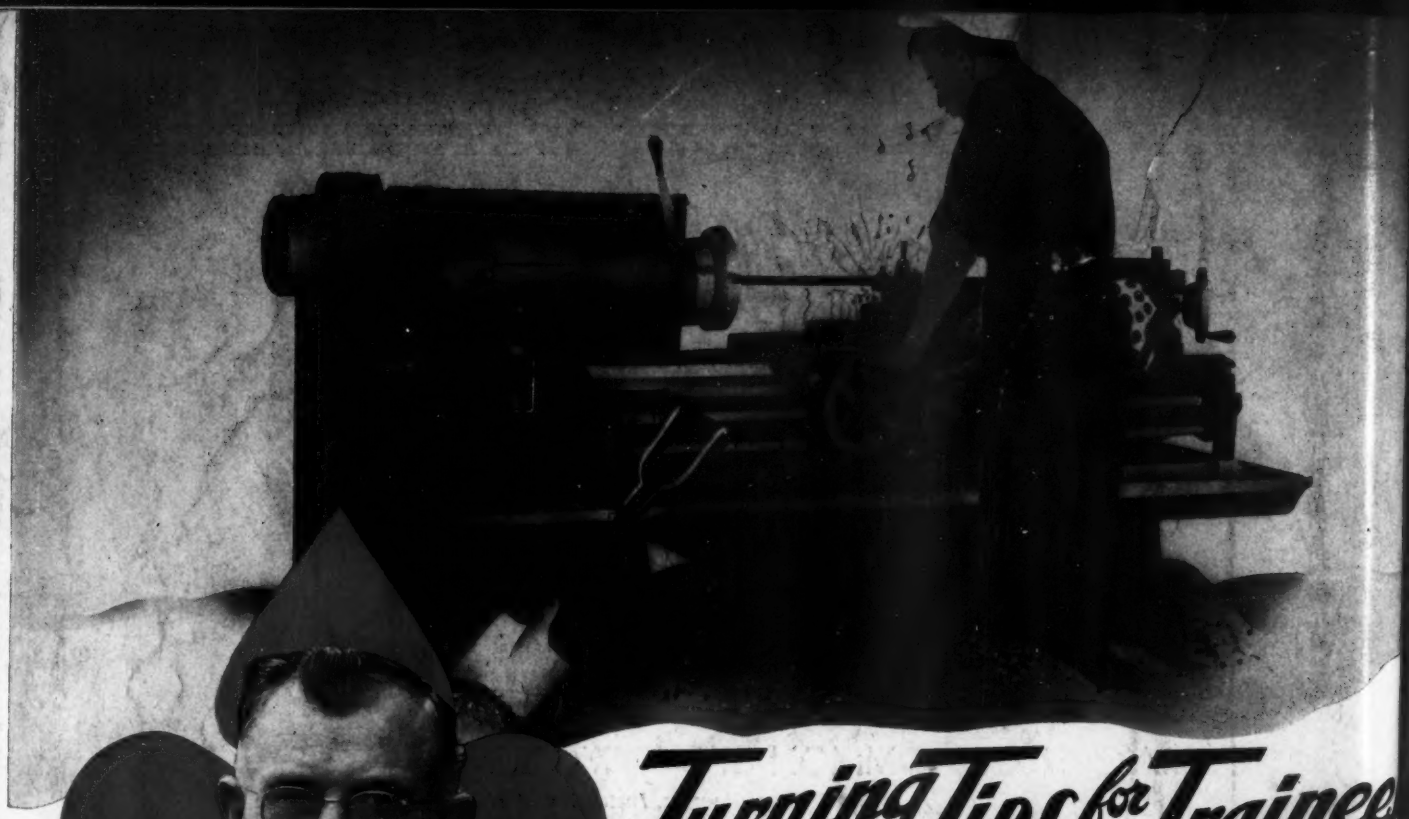
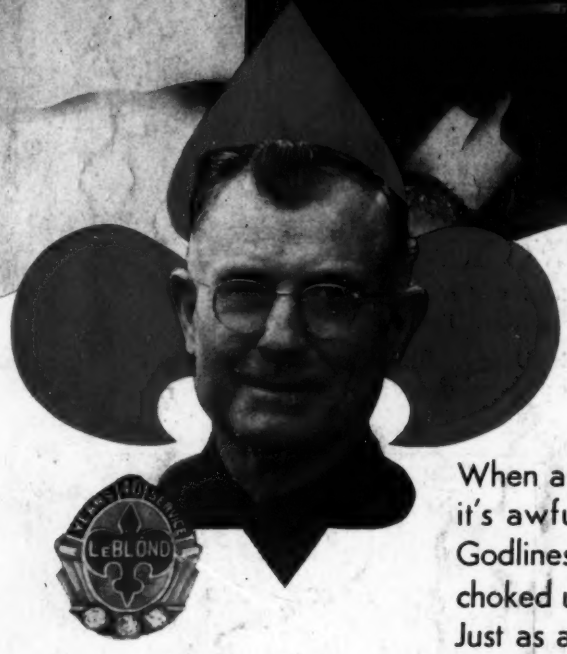




Turning Tips for Trainees

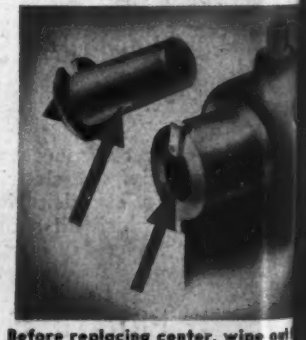
No. 4 in a series of "Turning Tips for Trainees"
By Old-Timer John Gauche, 40 years with LeBlond

When a lathe hand gets absorbed in turning out a piece of work, it's awfully easy for him to forget that Cleanliness is next to Godliness. But if he does forget, and allows his machine to get choked up with chips and turnings—look out, brother, that's trouble! Just as a reminder, I'd like to point out the spots that need close watching to keep your lathe running accurately and smoothly.

The wipers do a good job of keeping ordinary turnings out from under the carriage. But when you work with cast iron, you should remove the wipers occasionally and clean them in kerosene to rinse out the dust and grit.

When you place a tool in the tool post, check to be sure there are no turnings between the collar and the compound rest, or between the wedge and the collar. Your tool can't get a firm rest in a dirty tool post.

Don't move the tailstock along the ways without first carefully wiping off all chips. Turnings on the ways will throw the tailstock out of alignment and ruin your accuracy. Also keep tailstock spindle clean.



Before replacing center, wipe out hole and clean the tapered part the center. When using drills, cha or reamers be sure they are t in the taper hole. If there is between the two, the part revolve and cut the taper h

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